THE AMERICAN GAS LIGHT JOURNAL

REDMAN&KENNY,N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXX. No. 26. Whole No. 1,516. | NEW YORK, MONDAY, JUNE 27, 1904. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Where to Find the Western Gas Association's Exhibit and the Custodian Thereof at the World's Fair 1001

NOTICE—
Twelfth Annual Meeting, Pacific Coast Gas Association.....1001

EDITORIALS—
Briefly Told.....1001
Ladies' Day at the Joint Convention of the Western Association and the Gas Congress—The Meeting of the English Institution of Gas Engineers—A Proposed International Gas Exhibition.
The Gas Congress, by "W. F.".....1002
A Practical Test of Gas and Electricity as Sources of Motive Power, by Thos. Canning.....1003
*Central Station Office Methods and Accounting, by Mr. F. W. Frueauff 1004
Contents of the Question Box, Twentieth Annual Meeting, Ohio Gas Light Association—Continued from Page 968.....1006
*Gas Explosions, by Messrs. Bairstow and Alexander.....1009
Some Phenomena of the Adhesion of Steel and Concrete.....1010

SPECIAL ENGLISH CORRESPONDENCE 1011
High Pressure—The Institution of Gas Engineers—A New Use for Breeze.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.....1012
Promotion for Mr. F. W. Frueauff—The Norwich (Conn.) Transfer—Something from Vice-President R. B. Steward—Proposed Gas Supply for Harrington, Ills.—The Arlington (Mass.) Proceedings—Annual Meeting New Brunswick, N. J.—Mr. G. K. Dustin Goes to Hartford, Conn.—The Bennington (Vt.) Project—A Hint from Quincy, Ills.—Main Extensions, Columbus, Ga.—A Nassau (N. Y.) County Franchise—The Louisiana Engineering Society Visits the New Orleans Gas Works—Certain Boston Dividends—Will Elgin, Ills., Have Competition?—Agreement at Lincoln, Neb.—The Guthrie (O. T.) Company Ready—And Other Items.
The Market for Gas Securities.....1014

[OFFICIAL NOTICE.]

Where to Find the Western Gas Association's Exhibit, and the Custodian Thereof, at the World's Fair.

To the Fraternity: The exhibit of the Western Gas Association, at the World's Fair, St. Louis, is located in Section 33A, Liberal Arts Building, where Mr. Fred. R. Persons, who is in charge of the same, will always be on hand to receive visitors and to explain anything that requires explaining.

[NOTICE.]

Twelfth Annual Meeting, Pacific Coast Gas Association.

SAN FRANCISCO, CAL., June 6th, 1904.

To the Members of the Pacific Coast Gas Association: The Twelfth Annual Meeting of the Pacific Coast Gas Association will be held in the city of San Francisco, Tuesday and Wednesday, July 18th and 19th, 1904, and will be called to order at 10 A.M., Tuesday, by Mr. W. A. Aldrich, President. Place of meeting, Assembly Hall, Mechanics' Library, Post street, between Montgomery and Kearny.

The meeting of the Directors will be held Monday, July 17th, 1904, at 8 P.M., at the office of the Secretary, 427 Rialto Building, corner New Montgomery and Mission streets.

The following papers will be read:

President's Address, by Mr. W. A. Aldrich.

"Benefits of Consolidation," by Mr. John Martin.

"Some Practical Observations on the Flow of Gases in Pipes," by Mr. L. P. Lowe.

"Auld Lang Syne," by Mr. T. R. Parker.

"Notes Regarding California Petroleum," by Mr. P. W. Prutzman.

"Pressure Points," by Mr. E. C. Jones.

"From a Consumer's Standpoint," by Mr. John A. Britton.

"Effective Steam Plants for Gas Manufacture," by Mr. C. H. Pennoyer.

"American vs. English Gas Cooking Stoves," by Messrs. A. S. Main, Glasgow, Scotland; C. S. Barbour, London, England; H. Trenkamp, Cleveland, O.

"Wrinkles," edited by Mr. R. P. Valentine.

"Experiences," edited by Mr. Geo. S. Colquhoun.

"Novelty Department," edited by Mr. Geo. H. Hollidge.

"Question Box."

The annual banquet will be held Wednesday, July 19th, at 7 P.M.

The annual outing, for members, their families and friends, to Alum Rock, Santa Clara county, is set for Thursday, July 20th, particulars of which will be announced at meeting.

Arrangements have been made for a lecture on "Radium," to be given Tuesday evening, July 18th, by Prof. Edward Booth, of the University of California, to which members and their families will be admitted.

JOHN A. BRITTON,
Secretary.

BRIEFLY TOLD.

LADIES' DAY AT THE JOINT CONVENTION OF THE WESTERN ASSOCIATION AND THE GAS CONGRESS—"The powers in control of the 27th Annual Meeting of the Western Gas Association and of the First Congress of American Gas Associations agreed that 'Ladies' Day' should be fixed for the 17th inst., which was also the last day of the business sessions of the Congress, and the Committee on Entertainment accordingly arranged to care for the gentler sex in a befitting manner. That

LIBRARY OF CONGRESS
JUN 27 1904
COPYRIGHT

the Committee was successful in its efforts may not admit of truthful denial, for the several things brought off obtained hearty testimonials of approbation from those for whom they were prepared. The guests were many and attractive; indeed, the pleasures of the complete affair were greatly enhanced by the fact that the 165 pleasure seekers were bound to know each other, 'not as strangers.' Early morning of the set day boded ill as to weather conditions, but when noon was at hand, when the festivities were to begin, the Committee and its fair guests were greeted by an atmospheric state that was perfect. The first item on the programme was a ride over the avenues of the Exposition grounds, which took up fully an hour. The visitors were thus enabled to get a general idea of the scope of the Fair, and an excellent view of the exterior of all the buildings of note that go to make up this huge world's show. At the gate of the Tyrolean Alps the party was met by the Chairman of the Ladies' Committee on Entertainment (Mr. F. R. Persons), who escorted his fair burden to the beautiful dining room of Alpine fame, which will long be remembered when the Louisiana Purchase Exposition is a thing of the past. About one-third of the dining room was set apart for the use of the fair visitors and their escorts. The dividing lines were of ribbons and ropes of green vines. The table decorations as to their 'florality' were of sweet peas, field daisies, ferns and the like, and the effect of it all was exceedingly pretty. The menu comprised seven courses, and the service throughout was excellent. It is needless to add that it was enjoyed by all. The musical portion of the programme was carried out by Professor Starbuck, of Chicago, whose zither renderings were appropriately selected and beautifully executed, and later on by a band of Tyrolese singers, a specialty of whose work was some splendid 'Yodelling.' Later on the guests were conveyed to their respective hotels, and all voted that the afternoon had been pleasurably spent. The Committee in charge was thus composed: F. R. Persons, D. R. Russell, W. H. White, C. H. Dickey, A. B. Eaton, John L. Green, James Daniels, W. MacMorris and A. H. Boehnken.—Exhibit."

The Meeting of the English Institution of Gas Engineers.—From tne latest issues to hand of the *Journal of Gas Lighting* and *Gas World*, it is proven that the second annual general meeting of the Institution of Gas Engineers, which was held in London, the 7th, 8th and 9th insts., was a very successful one. The weather was perfect, the meeting room was in the Session Hall of the Institution of Mechanical Engineers, the officers were alert and resourceful, the attendance was large and representative, the technical proceedings were of the most interesting sort, and the entertainment was profuse, well directed and enjoyable. Mr. H. E. Jones, M.Inst., C.E., presided, and his address (which we hope to reproduce later on) was a masterpiece. He is succeeded in the Presidency by Mr. D. Irving, of Bristol. Papers read that have matter of especial interest to American gas men were: Descriptive of the De Brouwer Machinery at Derby, by Mr. J. Ferguson Bell; the "Flow of Gas in Mains and Distribution at High Pressure," by Prof. Unwin; and "Ten Years' Experience with Prepayment Meters," by Mr. Alfred Colson. The lecture on "The Mechanism of Combustion," by Prof. Harold B. Dixon, was in that learned gentleman's best vein. Taken as a whole, the meeting was a remarkably brilliant one.

A Proposed International Gas Exhibition.—We are in receipt of a copy of the "Preliminary Prospectus" setting forth the initial details of a proposed international gas exhibition, to be held at Earl's Court, London, Eng., from November 19th to December 17th, 1904. The scheme is under the dtrection of the Institution of Gas Engineers, and the President of the Exhibition is Mr. H. E. Jones, retiring President of the Institution of Gas Engineers. The list of Vice-Presidents and Patrons is an imposing one, and the former includes the names of Mr. Rollin Norris, President of the American Gas Light Association; Col. Frank S. Richardson, President of the New England Association of Gas Engineers; and Mr. F. H. Shelton, ex-President, Western Gas Association. The Organizing Manager is Mr. Frederic Budge, and the Exhibition Manager is Mr. G. D. Smith. The offices are in 119 to 125 Finsbury Pavement, London, E. C. Paragraph two of the Prospectus recites that, "European, American and other manufacturers of gas apparatus will be invited to exhibit their specialties side by side with British productions. Special facilities will be afforded to gas companies, corporations, engineers and all who are interested in the manufacture and use of gas to inspect all that is latest and best in the gas world, both from the scientific and utilitarian aspect." We will keep our advertisers advised, through our English correspondent (Mr. Humphrys), of the progress that is being made towards perfecting the preliminaries of the Exhibition.

[Prepared for the Journal.]

The Gas Congress.

By "W. F."

It is altogether probable that many who journeyed toward St. Louis to attend the first Congress of American Gas Associations felt sure that the sessions would be marked more by the absence than by the presence of the members, and that the meeting would probably be quite negative in results. On their homeward journey it is quite certain they realized that the attendance at and the interest in the proceedings were well above the average, and that in one, if not in two directions, the Congress had marked time and indicated a goal which is bound to be attained.

The 200 or more members of the Western Association and sister Associations who assembled to attend the one day session of the Western, found a most comfortable meeting room, the windows on both sides allowing free sway to the refreshing breeze that was a pleasant feature of the whole week. There was at times more noise from the outside corridor and the floor above than was desirable, but in view of the fact that there was a World's Fair crowd outside and that Queen Victoria's jubilee presents were above, more noise might have been expected, and what there was could be endured.

I begin with the Western Gas Association, because, to all intents and purposes, its session was part of the Congress proceedings. Something above the usual run of presidential addresses was expected from President Shelton, and there was no disappointment. The theory that the president of an association was a man who was well qualified to inform its members of the present state of the art and any striking advance made since the last meeting, was responsible for the "classic" form of presidential addresses and was of most value when the ordinary member did not read for himself, and the president could marshal his facts so as to make clear the bounds between known and unknown, telling what was attainable now and what the future might make possible.

In these days of many associations and of reading members, it often happens that a member who knows his business, but is not a logical thinker or a ready writer, talks in an indifferent way about matters with which his hearers are entirely familiar, and upon which he throws no new light. Undoubtedly this review of the state of the art and its progress, is better covered by a "Progress Department" than in a presidential address, and that president is wise who takes up one or two subjects on which he feels strongly, or about which he has some special information to give. This brings me back to Mr. Shelton and his address.

All will not agree with him upon the proper recognition of the death of a member. Obituary notices are usually so overdone that they fail to differentiate between the feelings of an Association upon the loss of an old, loyal and hard working member, and that of a non-attender and simply a payer of dues. The plan proposed by Mr. Shelton of having a tribute to each dead member prepared by some intimate friend, is preferable to the reference of all names to one committee. However, for success, this plan requires a wise choice in each case and a certain amount of editing by the Secretary.

When Mr. Shelton opened out on the rivalry, or rather the paralleling of work, as between the various Gas Associations, and instanced the late large increase in membership of the Ohio as an example, it is certain that he voiced what has been more and more in the minds of gas engineers each year, especially since the recent amalgamation in England; viz., how absolutely necessary it was for some plan of union to be effected in order to stop the waste of effort incidental to nine associations, and to put the gas engineer in the same rank from the association standpoint with the civil, mechanical and electrical engineers.

As this is not a reporter's account of all that occurred on the 3 days, but rather a discourse on the impressions received, I will proceed at once to treat of the house built by Mr. Doherty on Thursday, on the foundation laid by Mr. Shelton on Tuesday. When one considers that both architects worked in ignorance of each other, the adaptation of house to foundation is an additional proof of the statement in the last paragraph; viz., the conviction among all thinking gas engineers of the necessity for a union of the various gas associations. While, as Mr. Doherty pointed out, there may be changes advisable in the scheme he outlined, and while also the average man will allow himself to vote for a motion he does not approve, because he has not the moral courage or the actual brain to fight for his side, yet I do not believe the final scheme should be very different from the organization of the American

Institute of Electrical Engineers, and it is certainly the task of the objectors to a union to show why what has proved best for other professions should not be adapted to the advancement of the gas business. For the immediate success of union, very much will depend upon the composition of the committee of two members from each association and three members from the gas interests outside of any association, to be appointed by the various presidents, to formulate a plan of union for submission to the associations. If it is found feasible to continue names and organizations of the State associations, even though considered as local chapters (?) of the national organization, any opposition to union arising from the natural dislike to seeing their association wound up, of men belonging only to a local organization, should be removed. In the end union is bound to come, and how soon rests largely with the leaders of the profession. If they can agree on a scheme and unite to carry it out, the recalcitrants, if such there be, may be strong quantitatively but not qualitatively, and they will soon be compelled to swing into line.

Union is certainly the keynote struck by the Congress, and most of those who heard Mr. Doherty's paper and voted on the motions designed to put its recommendations into effect, must have been thrilled by the thought of the work possible to a Gas Association truly National.

I will return to the session of the Western long enough to note the repentance of Capt. White upon his ever having embraced the religion of high candle power. As is often the case with those who change their faith, Capt. White was very anxious to convince his hearers of the past, present and future errors of this religion, but the majority of the speakers seemed certain that in the past, the religion was absolutely essential to salvation, in the present it was quite valuable to many, and in the future while less valuable, its efficacy was not to be disposed of in a general statement.

In the absence of the Chairman of the Gas Congress Committee, the first session of the Congress was opened by Mr. Norris, as President of the American Gas Light Asecciation. During the sessions, the other presiding officers were Messrs. Shelton, Stone, Aldrich and Pratt, representing respectively the Western, Ohio, Pacific and Wisconsin Gas Associations.

In his address Mr. Norris, in a very clear and orderly manner, indicated the lines along which further economies might be effected in present practice, and where new processes might be expected to improve results. It was an excellent exposition of "where we are at" in the art.

Then came Mr. Shelton's paper on "The Labor Question." When one realizes that besides his Presidential Address he read a paper on "Coal Projectors" at the Western meeting, and had also a tremendous amount of work to do in connection with the exhibit, there comes an appreciation of how much energy he has expended towards making the whole affair a success. "The Labor Question" is quite to the point and ought to make every gas manager who has not yet reached the "First Step: Physical Comforts and Pleasures," do so at once; for in the neglect of the men involved, where this step has not been taken, there is no possible excuse. Also we should consider whether he can find any good reason for not taking the "Second Step: Mutual Benefit Associations." The "Third Step: Dividing Profits," and the "Fourth Step: Full Partnership," are not to be taken lightly; but, as shown by the experience of Sir George Livesey, success is possible along the front line of progress, where the pioneer has the brains and pluck. I hope the future will show that this paper, with the Livesey letter and the discussion that followed, gave new impetus to the solution of the labor question in our business.

Mr. Lotz's paper on the "Ventilation of Retort Houses" is an indication of the spirit of the times in regard to employees. Ten or 20 years ago, a hot and badly ventilated house was regarded as one of the necessary evils of the business, and little thought or money was spent in attempting to alleviate such a condition.

In the attempt to crowd into two short sessions the programme of the Congress, something or somebody was apt to suffer, and it fell to the lot of Mr. Donald McDonald, of Albany, N. Y., to be squeezed as to time. It is a great pity there could not have been a discussion on his paper, "Station Meters," for there is so little recent data on this subject, available to the gas engineer, that the questions and comments evoked by his excellent treatise would have been of great value.

In this connection, and before leaving the business part of this article, it is a consummation devoutly to be wished, that the new National Association will find out how to make all writers prepare their papers long enough in advance of a meeting to have printed copies circulated, so that at the session only a very short abstract be read, or such parts as the author wants to call especial attention to. This will allow time for debate, which is the great object of any association meeting. If Mr. Doherty's paper had been known to the Congress, and its reading dispensed with, many expressions of opinion as to the ideal form for the National Association might be available for the committee.

Due to the fact there was a great International Exposition with all the charm that this implies at St. Louis, to attract the members, and that there was more than the usual scattering among different hotels, there were very few gatherings to talk shop, after sessions were over. One took in a part of an Exposition building in the morning, on the way to the meeting, and in the afternoon, when work was over, a hasty lunch was had and then in little parties the sightseeing was again begun. There was not the usual haste to go home after adjournment, and probably most of the men stayed over until Friday and many a day later. For though there are slight imperfections, yet the Louisiana Purchase Exposition is well worth going 1,000 miles to see. To sit in the dusk, near the Louisiana Monument, and watch for the first glimpse of light on the Terrace of States, the Cascades, and the magnificent buildings around you, and to see the light grow from faint red points to a beautiful fairy glow was to be stirred to the depths in all of your nature to which the beautiful could appeal and to be proud of the country that could produce such a scene. By day, the walks between miles and miles of exhibits deepened the convictien of the vastness of our resources, and also showed that Japan and Germany (both are written very large all over the Exposition) do not intend to lose any chance of getting business and are factors to be reckoned with in the world's commerce. The government exhibit made one proud of the administration of national affairs. It was educational in every sense of the word, and on all sides the accumulated experience of the whole Nation was offered to the individval who might need it.

The Exposition relieved the Entertainment Committee of much thought as to programme, but they saw to it that the ladies were lunched and conveyed around the grounds. For the men they provided a journey in the beautiful waterway and a selection of the three best attractions on the Pike, and last but not least, the banquet at the Hotel Jefferson, where the arrangement of small tables, membership mutually selected, resulted in a very jolly gathering.

To sum up, none who went to St. Louis regretted the going, even that band known as "The Survivors of the Inside Inn" who looked for push-buttons and found semaphores, for bath tubs and found sentry boxes, and yet who, possessing a sense of humor and knowing the necessities imposed by Exposition conditions, did not regret their stay at the vast caravanserai. To those who did not go, I say: See the Exposition now and later on attend the next Gas Congress or, what will happen sooner, the first meeting of the new National Association.

A Practical Test of Gas and Electricity as Sources of Motive Power.

By THOMAS CANNING, Assoc.M.Inst.C.E., of Newport, in *Jour. of Gas Lighting.*

By the favor of Messrs. J. Linton & Co., Limited, builders and contractors, of Newport, I was permitted recently to make a comparison between work and the cost of the same performed by a gas engine and an electric motor respectively. The gas engine in this case is a Crossley of 6 nominal horse power, fixed on May 28, 1898. It works to a maximum of 16, and to a safe constant working load of 13.5 brake horse power. There was no special preparation for the test, no repairs were executed, and no alteration was made from the ordinary everyday working of the engine. It is also only fair to the makers to say that the engine has never been repaired since it was fixed, with the exception of the replacing of the ignition tube. The electric motor is of the Byng-Hawkins type, made by the General Electric Company, Limited. It is marked 14-horse power, 260 volts, 1,000 revolutions. The motor is a new one, whereas the gas engine has been in constant work ever since 1898. An admirable opportunity was given in this case for testing with exactitude the practical working of these motors, both gas and electric, because the contractors had placed upon each two identical sets of machinery made by the same maker, and guaranteed to turn out the same amount of work. The machines upon each were a planing machine, to plane timber 18 inches by 6 inches, and a circular moulding machine to work up to 6 inches in depth. These machines were fully employed during the test in planing and moulding pine. I was aided in the test by my Assistant and Inspector with the extra help, of course, kindly given by Messrs. Linton & Co., for the starting of the motors, etc.

First, both motors were stopped working, and the meters connected to each carefully read and duly recorded. The next step was to start the motors to work the machines above indicated for one hour, at the expiration of which they were again stopped, and the meters read and recorded as at the commencement of the test. From the start, the balance was in favor of the electric motor rather than the gas engine, because the latter had 35 feet of countershafting on six bearings, while the electric motor had only 16 feet on three bearings. Both motors, however, performed their work admirably, and when the time limit of one hour was reached, the recorded readings were as follows:

Consumption of gas..... 110 cubic feet.
Electricity..... 4.38 units.

An indicator diagram was taken of the gas engine; also the number of revolutions and explosions per minute were registered. These showed that it gave an energy of 6.2 brake horse power; being less than half its safe working load. A similar remark must apply to the electric motor, as it is quite evident that the absorption of 4.38 units did not represent more than half the power of that motor, allowing to it the maximum efficiency claimed by electricians, but, as is well known, seldom reached. However, my function is not to theorize, but to state exactly what was observed. The cost of 110 cubic feet of gas at 2s. 10d. per 1,000 cubic feet used during this experiment in the gas engine was 3.74d. I could not ascertain what charge was made per unit for electricity, because, as I was given to understand, it was made upon the maximum demand system, and varied according to the load and number of hours worked. But the lowest charge I understood at any time would be at the rate of 1d. per unit. Taking electricity, therefore, at this figure, and comparing it with gas at 2s. 10d. per 1,000 cubic feet, the result is quite clear that gas is by far the cheaper—viz., 3.74d. per hour, against 4.38d. for electric energy. In this engine, working under the conditions described, and not being a new engine, the consumption of gas was 25 cubic feet = 1 unit of electricity. In a new engine of the latest type, the gas consumed would have been much less. The calorific value of the gas at Newport, as tested by the Simmance and Abady calorimeter, averages closely 650 B.T.U.; and I attach much of the success of the trial in favor of the gas engine to the comparatively high calorific power of this gas.

As at Newport gas is sold at varying prices—from 2s. 6d. for power purposes—it may be useful here to make a comparison between the cost of gas and electricity at different rates. The following table is calculated on the basis of 25 cubic feet of gas = 1 unit of electric energy, which, as has been shown, is altogether too favorable to electricity; but it proves all the more conclusively that an electric motor has no real chance in competition with a modern gas engine, especially when working under full load.

Price of Gas per 1,000 Cubic Feet.		Costs, at Various Prices, per Unit of Electrical Energy Capable of Performing the Work done by One Pennyworth of Gas.					
		1d.	2d.	3d.	4d.	5d.	6d.
s.	d.	d.	d.	d.	d.	d.	d.
3	0	1.112	2.224	3.336	4.448	5.560	6.672
2	10	1.176	2.352	3.528	4.704	5.880	7.056
2	8	1.250	2.500	3.750	5.000	6.250	7.500
2	6	1.333	2.666	3.999	5.332	6.665	7.998
2	4	1.428	2.856	4.284	5.712	7.140	8.568
2	2	1.538	3.076	4.614	6.152	7.690	9.228

Even on the ample basis of 25 cubic feet of gas being equal to 1 unit of electricity, it will be seen from the above table that a consumer will pay 1.112d. for as much electrical energy as would do the work obtainable from a pennyworth of gas when gas is 3s. per 1,000 cubic feet and electricity only 1d. per unit; and so, in like manner, when gas is 2s. 6d. per 1,000 cubic feet and electricity 2d. per unit, a consumer will pay 2.666d. for as much electric energy as will do the work obtainable from a pennyworth of gas. The reader can easily follow the table, and make what further comparisons he may wish for.

In conclusion, I should like to draw attention to the calorific value of the gas, which it will be noticed was high. In view of the quantity of gas that is now used for cooking, heating, and motive power, it will be superfluous, I think, to insist upon the necessity of gas engineers maintaining the high calorific power of what is commonly known as town gas, which has a field of its own; and in that field no known source of energy can take its place, so long as its present high quality is conserved.

Central Station Office Methods and Accounting.

By Mr. W. Frueauff, Sec. an d Treas. Denver Gas and Electric Co.

Preliminary to reading his paper on the above subject read before the recent Boston Convention of the National Electric Light Association, Mr. Frank W. Frueauff said that the lighting companies throughout the country are all making an effort to increase their sales of current either to present users or new consumers, or by taking on business that was formerly done by isolated plants or other forms of power. These conditions have necessitated a much closer study of costs and receipts and have resulted in a much finer separation of the items entering into the cost of production for any particular class of current or for consumers using service in an unusual way. The usual method of grouping all expenses under the three arbitrary heads of manufacturing, distribution and general expenses and making separation under them for different sub-divisions desired, has only given costs and must therefore be misleading for purposes of figuring for new business to be secured or for analyzing present results in order to know the profitable from the unprofitable business. The plan of apportioning the costs of operation to the class of current made and of separating fixed and variable costs has therefore come to be a necessary part of a company's report of operations, and is now in operation among a number of companies with marked success.

The expenses occasioned in manufacturing and distribution for any one class of current are kept distinct from those incurred in another, so that the actual cost of manufacturing and delivering arc, power or alternating current is known separately. These costs for any one class are also separated to show the costs that are fixed as distinct from those that are variable. For example, station foreman, meter department, shop expenses, etc., are practically a fixed expense; that is, they are an expense resulting from the size and running of an electric business and do not noticeably vary as the business may increase or decrease. Some expenses depend upon the amount of current made and sold; that is, they vary with the output. For example, boiler fuel, firemen, lamp renewals, carbons, and so on. A third class of expenses is made up of those that vary with the number of consumers supplied or number of meters in use. Under this head may be included meter repairs, arc lamp repairs, service repairs, meter reading expense, collection and office salaries.

With the cost of current for any class of current separated into these three divisions, it is possible to know just what results are being obtained. One may then know whether or not the output expenses are increasing at a greater rate than the output, and if the expenses proportioned to consumer are increasing faster than the number of consumers. In figuring rates to be made to secure new business this plan of separating costs is particularly valuable. For example, in figuring to take on a long hour burning consumer you know from the figures of costs that the fixed costs will not be materially increased, nor will the consumer's expenses, and that only the output cost will be increased. You may therefore assume that this business can be secured at a very low figure and still show a much larger margin of profit than business that will add to your expenses of capacity or consumers while only showing a small amount of current used.

The electric companies are now realizing as never before that a satisfied consumer is one of their best assets. To make or hold these satisfied consumers requires constant and careful watching. A department of the business is established where these complaints are received and adjusted. They must be systematically followed up or great dissatisfaction will result. One plan in use is to record all complaints as received, showing the date, name, address, time complaint was received and nature of complaint. From this record typewritten orders in duplicate are made on a 3 by 5 slip, the original being sent to the inspection department immediately and the duplicate being held to insure the return of the original. The order is given to an inspector, who attends to the complaint as carefully as possible. He notes on the order the result of his investigation and signs it, when it is returned to the order or complaint department. The date of execution and name of man are entered on the record and the duplicate taken from the pack of outstanding orders. A reply postal card is then made out from the order, stating that complaint had been made of certain trouble and asking if our inspector had attended to it satisfactorily, these cards being sent in answer to all complaints. The reply cards do not all come back, but we are sure that if the investigation or work has not been satisfactory consumer will be sure to reply. If an unfavorable reply is received, an order is sent to inspection department calling attention to unfavorable report, and when work is again completed another reply card is sent. The original order is then sent to the filing room, where

all orders of every class are filed by dates under the street number, this file being used for reference from time to time and giving a complete history of all work done by the company at any house connected to our system.

A daily report is made from the order record, showing the number of complaints received, separated by classes, and showing the number of each class for same days of previous year and the accumulative number received during the past month. This report is sent to the general manager each day and enables him to keep in touch with the troubles coming up. At the close of each month a statement is prepared showing the number of complaints handled by each inspector and the number from which "unsatisfactory" reports were received on the reply cards, also showing the per cent. of satisfactory work done. This report, after being inspected and signed by the general manager, is posted in the inspection department where all men can see it. This plan of compiling the efficiency of the men has a splendid effect in stimulating them to careful and thorough work on all orders, and means a saving of time and money to the company and better feeling on the part of the public.

A new departure in the office is the establishment of a "bureau of information." This bureau is located in the most conspicuous point in the office and is in charge of a clerk thoroughly posted on all general matters of the company. His duties are to direct any and all inquirers to their desired point, such as application window, teller's window, manager's office, appliance department, etc. He has charge of the list of desirable vacant houses in the city, and upon request directs the inquirer to the real estate agent who has the property in charge. This list of houses includes only those along the company's lines or mains and only those that are equipped to use the company's service. By this plan we are able to get newcomers to the city, or those intending to move, to occupy houses where we can supply them without further investment. The list is revised each day by reports made from the soliciting and application departments of houses connected or disconnected. In connection with the bureau of information, bulletin boards have been placed at each plant, shop and department of the company. Upon these boards any announcements of changes of regulations, special inducements, information of particular importance to employees, and copies of all new advertising matter being sent out are posted, in order that the employees in every branch of the business may be kept in touch with what is going on, and may be in position to talk intelligently if questioned when attending to their duties, or after hours.

One of the most important requirements for satisfactory relations with consumers is the necessity for accurate meter reading and billing. The coupon system of meter reading cards, originated by Mr. S. J. Glass (see Fig. 1, in which only the coupons for two months are shown), seems

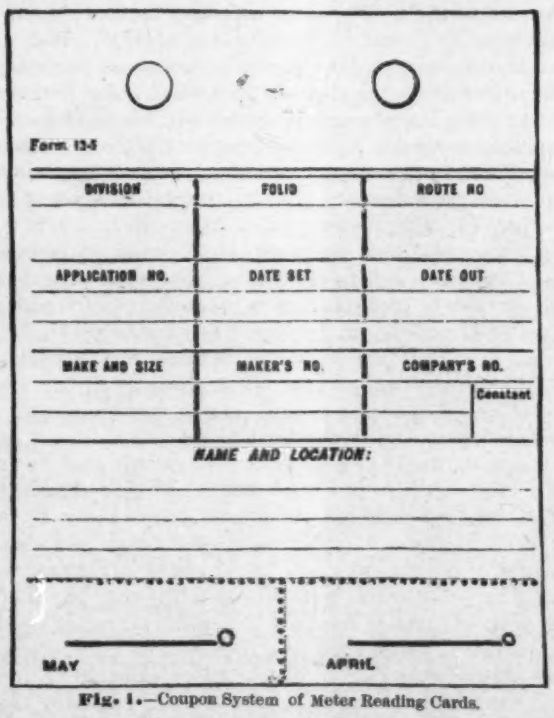


Fig. 1.—Coupon System of Meter Reading Cards.

to be the best and safest method in use. Under his plan a slip with 12 coupons attached is made for each meter; each coupon bears an identifying number, corresponding with the account on the consumer's ledger. After the meter has been read and bill made the coupon is detached and filed for reference. The meter reader then has only the meter number and house number to direct him when he next takes the reading. By this plan no reading can be averaged or readings put down without actually seeing the meter, and as the man has no previous reading to assist him, he must use unusual care to get the correct figures.

By keeping the same men reading each month and throughout the month and not picking up extra men each month to take statements, a considerable saving can be made, as men familiar with the routes can make much faster time and will not have to go back to get meters skipped or read wrong on the first trip. The plan of posting a list of all mistakes made by the meter readers will also increase the efficiency of this department. At the close of each month a list is posted in the department showing the number of meters read by each man and the number of errors discovered. A bonus is paid to each man who makes no mistakes during the month. One month's records show 13 men read 32,000 meters with a total of but 8 errors made by all these men.

The plan of recording and then posting a list of all errors made by the consumers' bookkeepers is followed. In this list appear any errors or omissions made by them, including errors in extensions and calculations, failure to send bill to proper address, omission of balance owed for previous period, and so forth. This posted list has the same stimulating effect as the lists of errors made by the meter readers and trouble men.

In the general office a Dey registering time clock is used. All office employees are required to register as they come into and leave the office. From this record the office time is kept. We find it of particular value in impressing promptness upon all employees; and as clerks are on duty from 7 A.M. to midnight, it is possible to know the time they arrive and leave without requiring the chief clerk or a timekeeper to note their movements. A list is posted each morning of any who have registered late in arriving or who have overstayed the hour off for lunch. At the close of each month a list is made of those who have been prompt and punctual throughout the month.

The use of card index records in offices is constantly growing and is satisfactory for most purposes. We are now using a house record (see Fig. 2) index in our application and order department. A card was

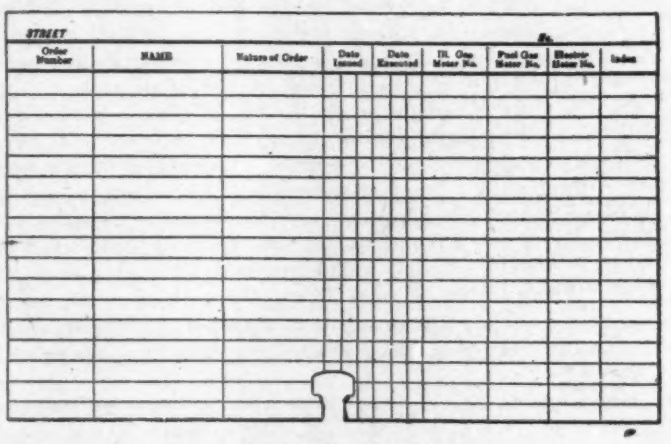


Fig. 2.—House Record.

made for each house connected, and as orders were taken to connect, disconnect, or change meter, arc lamp, etc., a posting to this effect was made on the house card; after the order had been executed the date of execution was entered on the card, so that we constantly have a record of our standing at each house. This has done away with all duplicate or wrong orders. Under the old plan of listing orders in a book or books we frequently sent men to re-read meters for a new tenant when we had just ordered the meter returned on instructions from the old occupant; but with the house card to refer to before sending order to shop for execution, a wrong order is detected and new one substituted to cover the latest development, or the order previously sent out is ordered recalled.

Visible writing typewriters with card holder attachments are used on all orders of every description. We find by their use fewer errors in copying and reading addresses and that names of consumers, being more legible than when written by hand, are correctly carried through the records and to the addressing machine.

The filing cabinet referred to before is also a feature in the card system. A guide card is placed for each street and number, and back of it are filed all completed orders for setting or removing of meters, complaints, connection of appliances, etc. If it is desired to refer to any original order, it is readily located by this plan.

For the record of stock of materials carried, a loose leaf system is in

use. One sheet is arranged for each article, showing amount on hand and received in one column, the amounts sent out in another, and a column to show the running balance of materials on hand.

This record is kept to show both the quantity and value of each article in stock, and is kept up each day from the storekeeper's reports of materials received and sent out.

After the monthly report is complete, the records therein shown are transferred to loose-leaf sheets containing columns for every item on the report; these figures are carried on an accumulative basis and always show the results for the past 12 months, this being done by adding or deducting the difference between the last month and the corresponding month last year, from the previous yearly total. These accumulative figures show much more clearly any real increase or decrease, and are not misleading, as the results for any one month might be. From these accumulative sheets a year's report can be made without any trouble or delay.

In Mr. Anthony's paper, read before the convention last year, he described several of the labor-saving methods in general use. I will, therefore, refer only to some not mentioned by him.

We use a Boettescher & Knecht machine in the teller's cage for receipting all bills. This machine is driven by an electric motor. The bill is placed in front of the machine by the teller, who then touches a spring; this releases the lock and sets the machine in motion, the bill is drawn under the roller, the coupon cut off and dated and dropped in a drawer below and the receipted bill forced out to the front of the window, where it may be picked up by the consumer.

We are now using an adding machine made by the Universal Adding Machine Company, of St. Louis, which has an electric driving attachment. Instead of pulling down a lever, as with the usual adding machine, a spring is touched which sets the machine in motion and performs the same office as the lever.

Self-adding sheets are a simple arrangement used in tabulating results, such as number of meters or consumers gained or lost, and so forth. The sheets are ruled for units and every 10th space is so marked. When all marks are down the number of vertical spaces times the number of horizontal spaces used shows the total desired.

The slide rule frequently used in engineering work can be made to play an important part in modern office methods. Clerks can be easily instructed in its use and calculations requiring multiplication or division worked out in much less time than by the old methods.

The Thatcher calculator, made by the Keuffel & Esser Co., New York, we have found the greatest labor saver yet tried. All costs and receipts are worked out on the reports on a basis of current made or sold. With several hundred separations, it will require a couple of days' time to do the division required. By the use of the calculator the results may be set down as fast as one can read the numbers on the machine. This machine is unique in construction and easily understood. Where a constant multiplier or divisor is used the results are shown more quickly than with any of the other calculating machines. This feature therefore makes it particularly valuable in use on monthly reports.

A tube system, such as is used in department stores, has been of great benefit to us. We have connection at all windows in the accounting office direct with the bookkeeping and collection rooms. If a copy of a bill is desired or explanation required, the detail can be secured in much less time than by going to consult the books and leaving the consumer waiting. We are able to do all bookkeeping work on another floor of the building, which is away from all the disturbance of the public office. We find that by this plan our bookkeepers are able to handle more accounts and with fewer interruptions.

We are now installing a Hollreith electric tabulating machine. This machine is now in successful operation in a number of railway accounting offices, in some large factories, and was used by the United States Census Bureau in compiling its statistics. The equipment consists of two parts: The punch, into which properly printed cards are set, transfers the information by punching a hole in the proper space. When all information has been transferred to the punched cards they are set in the tabulating machine, which sorts them into several kinds and then compiles the information. It is our intention to use this machine to tabulate our records of all consumers, to show the possibilities of each class of business, and to use it in making up the payrolls. Use will also be made of it in our engineering department in keeping track of our current made, sold and lost, of the various types and efficiencies of transformers and meters.

Your reporter received his appointment at such a late date as to prevent his making inquiries among the different members as to their experience with any new office methods or labor saving devices. I have, therefore, only mentioned some of the methods now employed in the Denver office. We have endeavored to keep in touch with all the newer plans suggested for accounting and for labor saving, and have adopted any that seemed to have advantages over those previously employed.

An analysis of steam generation enables us to determine what proportion of the generating expense should be charged to each class of current sent out from the station. The generating apparatus for the different kinds of service is usually not of the same efficiency. To compensate for this we apply the average efficiency of the apparatus to the output in kw-hours of each class of current. This gives us at the throttle valve of the engine the equivalent of the output from each class of current. From this point the generating expenses proportional to output are common. Having this equivalent steam energy, we can divide the generating expense in the same proportion that this equivalent energy appears. This would give us expense proportional to output, which should be charged to each class of service. The expenses proportional to capacity should be divided in proportion to the capacity of each class of apparatus in the station.

[Continued from Page 968.]

Contents of the Question Box as Read at the Twentieth Annual Meeting, Ohio Gas Light Association, Cleveland, O., March, 1904.

No. 33. "What is the specific heat of the products of combustion of coal gas?"

"The specific heat of the products of combustion of a coal gas may be ascertained as follows. It is assumed that by volumetric analysis, the gas in question is fonnd to be composed of

	Per Cent.
Carbon dioxide (CO_2)	1.8
Olefiant gas (C_2H_4)	5.9
Oxygen (O_2)	1.1
Carbon monoxide (CO)	3.6
Methane (CH_4)	42.8
Hydrogen (H_2)	40.9
Nitrogen (N_2)	3.9

"The weight of one cubic foot of CO_2 at 60° and 30″ is 816.65 grains, and, therefore, in one cubic foot of the above gas 14.70 grains of CO_2 will be present. CO_2 cannot be burned, therefore, 14 70 grains of CO_2 will be present from this source after combustion. The weight of one foot of C_2H_4 is 528.25 grains, and, therefore, 31.17 grains will be present. C_2H_4 is composed of 6 parts of carbon to 1 part of hydrogen by weight, therefore, 26.72 grains of carbon and 4.45 grains of hydrogen will be present. Since 8 parts by weight of oxygen are necessary to completely consume 3 parts of carbon, the combustion of the 26.72 grains of carbon will produce 97.97 grains of CO_2. Since 8 parts of oxygen to 1 part of hydrogen are necessary for combustion, 4.45 grains of hydrogen will produce 40.05 grains of H_2O. The oxygen will unite with either the carbon or the hydrogen during combustion and may be neglected for the present. The weight of one cubic foot of CO is 522.03 grains, therefore, 18.79 grains will be present. Since 4 parts by weight of oxygen to 7 parts by weight of CO are necessary for combustion, the 18.79 grains of CO will produce 29.53 grains CO_2. The weight of one cubic foot of CH_4 is 300.84 grains, therefore, 128.76 grains will be present. CH_4 is composed of 3 parts of carbon to 1 part of hydrogen by weight, and, therefore, 96.57 grains of carbon and 32.19 grains of hydrogen will be present. Since 8 parts of oxygen are necessary to completely consume 3 parts of carbon, the combustion of the 96.57 grains of carbon will produce 354.09 grains of CO_2. Since 8 parts of oxygen to 1 part of hydrogen are necessary for combustion, the 32.19 grains of hydrogen will produce 289.71 grains of H_2O. The weight of one cubic foot of hydrogen is 36.98 grains, therefore, 15.12 grains will be present. Since 8 parts of oxygen to 1 part of hydrogen are necessary for combustion, the 15.12 grains of hydrogen will produce 136.08 grains of H_2O. The weight of one cubic foot of nitrogen is 520.82 grains and, therefore, 20.31 grains will be present. N_2 cannot be burned and, therefore, 20.31 grains of N_2 will be present after combustion. In the combustion of the various gases 753.57 grains of oxygen will be used and since only 6.52 grains were present in the coal gas the rest, 747.05 grains, must be supplied from the air. Since air is composed of 23 parts of oxygen and 77 parts of nitrogen there will be 2,500.96 grains of nitrogen left after combustion. From the above calculations it will be seen that the combustion of one cubic foot of coal gas, with the necessary air, will yield 496.29 grains CO_2, 465.84 grains H_2O and 2,521.27 grains of N_2.

"The specific heat of CO_2 at constant pressure is 0.217; the specific heat of N_2 is 0.2438; the specific heat of superheated steam is 0.4805;

497.29	× 0.217	= 107.695
2,521.27	× 0.2438	= 614.686
465.84	× 0.4805	= 223.836
3,483.40		946.217

946.217 + 3,483.40 = .2717

"The specific heat at constant pressure of the products of combustion of coal gas is about .2717, assuming that the temperature is above the boiling point of water and below that at which a marked increase in the specific heat of CO_2 and N_2 occurs.—W. B. TUTTLE."

"For the figures of least doubtful value on the specific heats of CO_2 and H_2O at high temperatures, refer to lecture before the American Gas Light Association, by Prof. A. H. White, published in AMERICAN GAS LIGHT JOURNAL, Nov. 16th, 1903, and elsewhere.—H. B. HARROP."

"Specific heat of nitrogen at constant pressure is 0.244. Specific heat of CO_2 and water vapor varies with the temperature. The following table, compiled by M. E. Derval, shows the mean specific heat at different temperatures:

Temperatures Deg. C.	Temperatures Deg. F.	H_2O Vapor.	CO_2.
0	32	0.420	0.184
100	212	0.438	0.192
200	392	0.456	0.200
400	752	0.492	0.215
600	1,112	0.529	0.228
800	1,472	0.565	0.240
1,000	1,832	0.602	0.251
1,200	2,192	0.638	0.261
1,400	2,552	0.674	0.270
1,600	2,912	0.711	0.278
1,800	3,272	0.747	0.286
2,000	3,632	0.784	0.293
2,200	3,990	0.820	0.300
2,400	4,352	0.856	0.306
2,600	4,712	0.893	0.312
2,800	5,072	0.929	0.318

"To find the average specific heat of the mixed products of combustion, multiply the weight of each of the products by its corresponding factor of specific heat and divide the sum of the products by the total weight.—ROBERT LINDSEY."

No. 34. "What is the cheapest means for obtaining CO_2 for gas making purposes?"

"The CO_2 can be obtained cheapest from the chimney flue, but it will be mixed with nitrogen, however. It costs but very little to obtain it from this source, while other methods involve the use of costly chemical agents.—E. J. SHERWOOD."

No. 35. "Is there not some way to completely gasify tar?"

"Tar is composed partly of solid carbon held in suspension. This has never been gasified, except perhaps in the electric arc.—JAMES FERRIER."

"Tar cannot be converted into a permanent gas by any direct method of distillation. William E. Barnes, Civil Engineer, of London, Eng., publishes a manual on the manufacture of gas from tar, oil and other liquid hydrocarbons, in which he claims that gas of 16-candle power can be produced from tar for 4 cents per 1,000 cubic feet. The process seems complicated and has not attained commercial success.—JAMES W. DUNBAR."

"This question appears to suggest that tar would be more valuable as gas than as tar. See Schilling's *Gasbeleuchtung*, 3d Edition, page 230, *et seq.*; and Lunge, chapter on "Applications of Coal Tar Without Distillation," showing that all attempts heretofore made to gasify tar have proved impracticable.—H. B. HARROP."

"Yes; but the game is not worth the candle. Stopped pipes and pitch in the hydraulic main and trouble all around are the results.—W. E. BROWN."

"I gasify my tar entirely by running the tar into the mouthpiece of retort No. 1, the vapor of the tar going through this retort, at the end of the same to a 5-inch pipe connecting the No. 1 with the upper retort No. 2, the gas going through No. 2 to standpipe and hydraulic main. The retorts are charged with coal in just the same way, whether tar is running or not. In the retort No. 1 there is a 1-inch pipe put through the mouthpiece lid and oil put on top of the coal, the vapor of the oil being fixed in the same way as that from the tar. I think the best way would be to have a small still, either heated by the waste heat of the bench or in larger works direct-fired, to make the tar into pitch and only the vapors of the tar to be run through the retorts. I cannot give the candles per gallon, but in this process steam is not necessary and no retorts are laid off for oil gas. If the retorts are only used for coal and oil, it is not absolutely necessary to have two retorts combined, but the oil pipe will have to extend close to the back end of the retort. The make of the retorts can be doubled at will at short notice.—G. FALKENSTEIN."

No. 36. "Has anybody done anything to determine the question of last year's box regarding the depreciation of coal?"

"Our experience in the question of storage would indicate that there is a loss of about 20 per cent. in coal which is stored for 1 year.—ALTON LIGHT AND TRACTION COMPANY."

"Yes. Mr. Garnet McKee, of the Detroit City Gas Company, has recently made an investigation of this subject, and has submitted his findings to the McMillin Companies' Association. He finds that the deterioration is much more rapid at first than later, and that it is virtually limited to the gases occluded in the coal.—IRVIN BUTTERWORTH."

No. 37. "What is the best and quickest means of determining when an iron oxide has ceased to do useful work?"

"By the lead acetate test.—HOWARD E. MANN."

"By the practical experience of well-known gas engineers, a box of iron oxide containing 50 per cent. of sulphur compound is considered unfit for use. The amount of sulphur can be determined by taking a small sample of iron oxide from a batch you have decided to test, and by passing liquid carbon bisulphide through this. The sulphur will be carried over to a vessel provided for its return, and there deposited. After this has been dried the amount of sulphur is weighed, and you have the per cent. of sulphur the iron oxide contains.—J. M. COLES."

"A convenient and inexpensive method of finding out how the boxes are working consists of an ordinary test tube of say, 12 inches long and 1 inch diameter, fitted with a 2-hole rubber stopper, through which are placed glass tubes, one reaching to within 4 inches from the bottom of the tube, the other just below the stopper. A solution of lead acetate of convenient strength is placed in the tube 3 inches in depth. A strip of white, bibulous paper, 10 inches long, preferably such paper as photographers use for drying prints (as it is free from sulphur), is immersed in the solution in the tube. It will be kept moist by capillary attraction. The long tube is, of course, the inlet, and it should be bent so that the gas will impinge against the paper an inch or so above the surface of the liquid. As the test is continuous, an inspection from time to time will show at once the condition of the boxes.—ROBERT LINDSEY."

"The limit of the working of an iron oxide bed has heretofore been placed by the number and capacity of boxes in series, and not by the fact that at any time the said bed became inoperative or had 'ceased to do useful work.' It has been definitely determined that the foul box in a 4-box series is doing a great deal of useful work at the time that it has to be shut off on account of the point at which the gas becomes clean approaching dangerously near to the outlet of the last box. The United Gas Improvement Company, at Philadelphia, is now using a 6-box series, and I am told finds the same conditions obtain there, though, of course, to a less degree. Therefore, it may be said that, under existing practice, an iron oxide bed does not 'cease to do useful work.—R. B. BROWN."

"We throw it away when it ceases to do our useful work and fails to revivify. We settle this by actual test.—E. M. OSBOURNE."

"The best and quickest means of determining when an iron oxide bed has ceased to do useful work is to make a quantitative estimation of H_2S in the gas before and after passing through the box. A quick method is to have the United Gas Improvement Company's H_2S apparatus, which expresses the grains of H_2S per 100 cubic feet of gas.—J. A. SCHAEFER."

"If the boxes properly purify when freshly filled, place white paper coated with sugar of lead in the escaping gas direct from purifiers, and if purifiers have ceased to do their work, the paper will turn black.—E. W. SMITH."

No. 38. "What is the advantage or disadvantage of using steam for decarbonizing retorts?"

"By the proper use of a steam jet, the carbon may be properly removed from a retort in from 5 to 15 minutes, and the retort kept in service without the loss of a single charge. The advantage over the old method of burning the carbon out slowly and losing a charge or more is readily seen. If properly handled, there is no more damage done in the retort than by the slower method.—CLARENCE S. LOMAX."

"The disadvantage of using steam is that it will open up the pores of a retort more than air.—E. C. FLEGER."

"There is no advantage in using steam for the removal of carbon from retorts; on the contrary, I know of but few better ways to destroy them.—J. H. ENRIGHT."

"Steam and air will take carbon off quickly and without damage to retorts.—W. E. BROWN."

"The answer to this question in my experience has been on the disadvantageous side. I have found little or none on the advantageous side. Steam alone will not do the work. You must add air by making your steam jet act as a siphon. Then the steam has to be thoroughly dry, and to do this you will have to add a superheating coil to jet, either by running a return coil in the combustion chamber of the bench or in the same retort that is being decarbonized. The cost of keeping this coil in repair will offset any advantage that might be gained by the method. I have used steam to decarbonize retorts and with the best conditions possible have found it will work only on a very hot, new retort. If the retort is at all below a bright orange, the steam will turn it black before taking out the carbon. Likewise if the retort is cracked and the carbon fills the crack, the steam method will not work in a short enough period of time to make it pay.—J. T. MASON."

"The only advantage of steam over air in decarbonizing is in the saving of the carbon.—R. SHACKLETTE."

"The answers to this question bring out some of the disadvantages of both air and steam. We are successfully using a decarbonizer at Denver, in which both air and steam are used, and while it is not yet in perfect shape, the results secured from it are satisfactory and we think much more desirable than from the use of either air or steam alone. A pipe of greater diameter incloses a pipe of lesser diameter, the outer pipe carrying compressed air the inner carrying steam. Holes are drilled in the outer pipe for the escape of the air and steam in a manner calculated to cut channels through the formation of carbon, and smaller holes are also drilled in the inner pipe midway between the holes in the outer pipe, through which steam escapes into the space between the external periphery of the inner pipe and the internal periphery of the outer pipe. As this steam must travel forward or backward to find an opening in the outer pipe through which to escape, it keeps the temperature of the outer pipe down to a safe point, preventing rapid deterioration, and the mixture of escaping steam and air is intended to be so proportioned that the heat generated by the burning of the oxygen of the air and the freed oxygen of the steam is just sufficient to counterbalance the heat absorbed by decomposing the steam. This decarbonizer will be more fully described either in the Wrinkle Department or at some later time. It has reduced the time of decarbonizing 80 per cent.—EDITOR."

No. 39. "What are the advantages or disadvantages of using compressed air for decarbonizing?"

"The disadvantage of using compressed air consists in the fact that too high a temperature may be generated in this way in the retort wall itself.—CLARENCE S. LOMAX."

"In using compressed air for decarbonizing retorts, you can do the work in less time (4 hours) than by the use of steam, and the life of the retorts will be longer.—C. W. WALLACE."

"Best method we have tried. Cheaper than the steam process and much quicker. We have a 2-inch wrought iron pipe from the water gas blast pipe running along the front of the benches with tees at convenient points for connecting up a piece of 2-inch pipe which is laid in the retort to be decarbonized.—W. E. HARTMAN."

"The advantage of using compressed air for decarbonizing is the increase in the rapidity with which this operation can be accomplished, together with avoidance of any cooling of the surface of the retort. The disadvantages are cost and the very high temperature produced in the interior of the retort, increasing the wear and tear on mouthpiece, standpipes and scurfing fittings.—R. B. BROWN."

"The advantages of this method are as many if not more than the disadvantages of the preceding method. With air under 25 pounds pressure per square inch or more, any retort, no matter how bad the carbon is, can be cleaned out thoroughly and only one charge missed. It will take a little longer where the retort is broken or cracked, but it will do the work and do it quickly. All that is needed is the compressor, a tank and a line of pipe in front of the benches with valves, and union connection at each bench to connect hose, or, what is better, a swing joint that will reach any retort in the bench. The pipe which extends about two-thirds the length of any retort need not be larger than 1 or 1¼ inches.—J. T. MASON."

"The advantage of air in decarbonizing is in the rapidity with which it can be accomplished."—R. SCHACKLETTE."

No. 40. "Does ammonia have a greater affinity for H_2S than CO_2?"

"Greater for H_2S.—HOWARD E. MANN."

"Affinity for CO_2 is greater.—JOHN GIMPER."

"Ammonia has a greater affinity for H_2S than for CO_2. Strong acids have greater affinity for strong bases than for weak bases, and vice versa. Both H_2S and CO_2 are acid in character, and CO_2 is the weaker, H_2S being strong enough to displace carbonates.—E. J. SHERWOOD."

"Greater affinity for CO_2.—DONALD DAVIDSON."

"The tables below, which are tabulated from results obtained while experimenting with samples of ammonia liquor taken from the washer scrubber, tower scrubbers, condensers, etc., will clearly show that ammonia has a greater affinity for CO_2 than for H_2S. For instance, at

7,000 Grains Liquid Taken from Standard Scrubber, Temperature Room, 70° F.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Temperature.	Ammonia Present in Grains.	Ammonia Grains Driven Off.	Ammonia Percentage Driven Off.	Total Grains of Ammonia Driven Off.	Total Percentage of Ammonia Driven Off.	H_2S Present in Grains.	H_2S Grains Driven Off.	H_2S Percentage Driven Off.	H_2S Total Number of Grains Driven Off.	Total Percentage of H_2S Driven Off.	Grains Driven Off per Grain of NH_3.	Total Grains Driven Off per Grain of NH_3.	CO_2 Present in Grains.	CO_2 Grains Driven Off.	CO_2 Percentage Driven Off.	CO_2 Total Number of Grains Driven Off.	Total Percentage of CO_2 Driven Off.	Grains Driven Off per Grain of NH_3.	Total Grains Driven Off per Total Grain of NH_3.
70	217.7					11.9							217.0	.0					
80	217.0	.7	.3215	.7	.3215	11.0	.9	7.564	.9	7.564	1.286	1.286	216.0	1.0	.4608	1.0	.4608	1.4285	1.4285
90	215.6	1.4	.6452	2.1	.9648	10.1	.9	8.182	1.8	15.13	.6429	.8571	212.1	3.9	1.806	4.9	2.258	2.786	2.333
100	206.5	9.1	4.221	11.2	5.145	8.8	1.3	12.87	3.1	26.05	.1429	.2768	197.2	14.9	7.026	19.8	9.125	1.6374	.1878
110	203.0	3.5	1.695	14.7	6.753	8 3	.5	5.682	3.6	26.56	.1429	.2449	194.1	3.1	1.572	22.9	10.55	.8857	.1558
120	197.4	5.6	2.759	20.3	9.325	7.5	.8	9.638	4.4	36.98	.1429	.2167	190.5	3.6	1.855	26.5	12.21	.6429	1.305
130	194.6	2.8	1 419	23.1	10.61	6.6	.9	12.00	5.3	44.55	.3211	.2294	152.1	38.4	20.16	64.9	29.91	13.712	2.809
140	181.3	13.3	6.835	36.4	16.72	6.1	.5	7.575	5.8	48.75	.03759	.1593	130.1	22.0	14 77	86.9	40.08	1.654	2.3872
150	174.3	7.0	3.861	43.4	19.94	4.4	1.7	27.87	7.5	63.04	.2429	.1728	126.1	4.0	3.074	90.9	41.89	.5714	2.0946
160	119.7	54.6	31.82	98.0	45.01	3.5	.9	20.45	8.4	73.60	.01648	.08572	119.9	6.2	4.917	97.1	44.74	.1135	.9908
170	116.9	2.8	2.339	100.8	46.30	2.6	.9	25.71	9.3	78.16	.3214	.09223	96.4	23.5	19.64	120.6	55.30	8.395	1.1963
180	87.5	29.4	25.15	130.2	59.81	.8	1.8	69.22	11.1	93.28	.06123	.08533	48.7	47.7	49.48	168.3	77.55	1.5202	1.2925
Boiling 190.. ... 5 min.	68.8	18.7	21.38	148.9	68.40	.5	.3	37.50	11.4	95.81	.001604	.07654	20.9	27 8	57.09	196.1	90.36	1.4865	1.317
boiling.. 10 min.	51.1	17.7	25.73	166.6	76.26	.4	.1	20.00	11.5	96.66	.005649	.06902	5.7	15.2	72.71	211.3	97.38	.6588	1.2682
boiling. 25 min.	31.5	19.6	38.36	186.2	85.54	.2	.2	50.00	11.7	98.34	.01162	.06283	3.5	2.2	38.60	213.5	98.30	.11277	1.1475
boiling.. Add	23.8	7.7	24.44	193.9	89.06	.0	.2	100.00	11.9	100.00	.01648	.06138	0.0	3.5	100.00	217.0	100.00	.4546	1.119
K.O.H.	00.0	23.8	100.00	217.7	100.00	.0	.0	.....	11.9	100.00	.. ..	.05466	0.0	0.0	.....	217.0	....	.....	.9969

70° F. the amount of CO_2 present is from 6 to 23 times as much as H_2S. —J. A. SCHAEFER."

"Ammonia has a greater affinity for carbonic acid.—CLARENCE S. LOMAX."

No. 41. "Which will be freed from ammonia liquor the more quickly by heating H_2S or CO_2?"

"CO_2 will be liberated more quickly than H_2S.—HOWARD E. MANN."

"H_2S will be liberated first.—JOHN GIMPER."

"The CO_2 will be freed by heat from ammonia liquor more quickly than will H_2S. The affinity of NH_3 for H_2S being stronger than that for CO_2, the sulphide formed in the first case will be more stable than the carbonate with the latter, and when heated the CO_2 will be driven off first. For the action of these compounds, see Remsen's 'Inorganic Chemistry.'—E. J. SHERWOOD."

"This question can easily be answered by referring to the charts accompanying answer to question No. 40. Upon heating ammonia liquor and testing at each rise of 10° F., the percentage of freed H_2S is much greater than that of CO_2. This can be seen by comparing columns 10 and 17.—J. A. SCHAEFER."

"H_2S.—DONALD DAVIDSON."

[To be Continued.]

Gas Explosions.

[By L. BAIRSTOW, A.R.C.Sc., Wh.Sc., and A. D. ALEXANDER, A.R.C.Sc., in *Engineering*.]

The previous experiments in this subject usually referred to are those of Mr. Dugald Clerk and Mr. Grover. The present paper deals chiefly with the results obtained by the latter when determining the effect of the products of combustion on the next explosion.

Stated briefly, Mr. Grover found that with mixtures of coal gas and air in which the volume of the coal gas is less than one-eleventh of the whole volume, there is an advantage in replacing some of the excess air by the products of a previous explosion. Above one-eleventh, the effect of the addition of burnt products, in small proportion, is to give a very slight increase of pressure; a large proportion is decidedly prejudicial to the maximum pressure.

In commenting on the difference between the maximum pressures for pure mixtures as obtained by Mr. Clerk and by himself, Mr. Grover says: "The difference is no doubt due to the fact that water was present on the walls of the cylinder * * *."

The present experiments were made in a cylinder not wetted, as was Mr. Grover's. The cylinder is, however, never quite dry, because of the water formed by combustion.

A series of experiments[1] on mixtures at an initial pressure of one atmosphere are shown in comparison with Mr. Grover's results in Fig. 1. The agreement, with one exception, is very close, and in that case the low pressure was probably due to imperfect mixing.[2]

Experiments since that time, with a different method of firing, have given slightly higher pressures for weak mixtures, but still much lower than those of Mr. Clerk's.

From these it appears that the difference between the various series of experimental results is due, not to the different degree of wetness of the cylinder walls, but to the different composition of the coal gas.

In making the following experiments the gas was obtained from a small holder of 6 cubic feet capacity, so that at least each series was made on gas of the same composition. Moreover, the gas in the holder was always at atmospheric pressure.

The explosion cylinder was as used in the experiments previously referred to, with the exception of the sparking arrangement. This latter in the present series consists of four sparks along the axis of the cylinder, the sparking being across gaps in one continuous circuit.

With this arrangement a remarkable change in the diagrams was noticed when the volume of the gas was about 0.086 of the total volume of the cylinder.

The experiments were conducted at an initial gauge pressure of 40 pounds per square inch, and Fig. 2 shows characteristic explosion curves. With the richest mixture— viz., that in which the volume of the gas was 0.127 of the whole volume—the pressure curve is very steep immediately on each side of its maximum.

[The ratio of the volume of gas to the combined volume of gas and air will be referred to as "richness" to distinguish it from the ratio of the volume of gas to the volume of air, which is usually called "mixture."]

1. See *Engineering*, November 28, 1902.
2. See *Engineering*, October 30, 1903.

With a richness of 0.100 the diagrams show at the top some signs of flattening, and this decidedly develops when the richness is 0.091. For a richness of 0.086 the diagrams show that the pressure becomes constant for a considerable interval before finally rising to its maximum. With less rich mixtures there is no trace of the part of the curve above this shelf.

The maximum pressure decreases almost to the initial pressure as the richness decreases to 0.057, and even then the mixture is usually readily inflammable with the new arrangement of sparks. It is, however, exceedingly difficult to get below this "shelf" with a single spark near the cylinder cover, and, remembering the difference in the composition of the gas, it is probable that Mr. Clerk's experiments stopped at this point.

In each case two experiments were made, the mixtures being as nearly as possible alike; an indicator diagram was obtained from the first, but not from the second, the object being to reduce the leakage in the second to a negligible amount. After cooling, the pressure is always below the initial pressure, the decrease, when there is no leakage, being due to the combustion and subsequent condensation.

From this pressure the fractional loss of volume (Q of Fig. 3) has been calculated, and the result plotted with the value of the "richness" for abscissa. If all the gas in the cylinder were burnt, the loss of volume, and therefore the loss of pressure, would be proportional to the volume of gas admitted—that is, to the richness.

It will be seen from Fig. 3 that the portion *C D* is directed towards the origin, as required for complete combustion (analysis shows that for mixtures corresponding to *C D* combustion is very nearly complete); whilst at *C*—*i. e.*, the "shelf"—a sudden drop occurs to *B*, after which the loss of volume becomes rapidly less and less until at *A* no burning occurs. The maximum pressure also decreases to zero at the same point.

In all cases the air is in sufficient quantity to burn the gas completely.

For mixtures less rich than that represented by *C B*, combustion is not complete, and the products will contain combustible gases. It was thought that this would probably explain Mr. Grover's results, and for this reason the diagrams from which the data for Fig. 1 were taken were again examined; only the last one, giving a maximum pressure of 12 pounds per square inch, was found to correspond to mixtures below the "shelf."

It now became necessary to ascertain where the products of combustion would cease to give any good effect, and for this purpose the maximum increase of pressure given by Mr. Grover's curves (page 224, "Modern Gas and Oil Engines") has been plotted. This is shown by the dotted line in Fig. 1.

It will be seen that the good effect resulting from burnt products ceases at the vertical line, which indicates the position of the "shelf." The authors, therefore, concluded that Mr. Grover's results could be obtained in a dry cylinder, and made experiments to test this conclusion.

The mixtures were at an initial gauge pressure of 14.7 pounds per square inch—*i. e.*, 2 atmospheres—and ranged from a richness of 0.067 to one of 0.085. This range includes the shelf already referred to. A table of results is given:

Richness.	Products Per Cent.		Maximum Gauge Pressure.
0.067	0		27
	10		52
	0		28
	20		60
	0		28
	30		65
		Shelf	
	0		28
	40		92
	0		29
	50		132
0.071	0		55
	10		67
	0		51
	20		68
	0		57
	30		68
		Shelf	
	0		61
	40		75
	0		60
	50		112
0.081	0		65
	10		65
		Shelf	
	0		65
	20		85

Richness.	Products Per Cent.	Maximum Gauge Pressure.
	0	61
	30	104
	0	68
	40	95
	0	65
	50	146
0.085	0	77
	10	66
	0	88
	30	68
	0	77
	50	70

The "shelf" in the pure mixtures comes between 0 081 and 0.085.

After each pair of experiments the cylinder was cleared of products by first forcing air through it, by pumping, an air pressure of 20 pounds per square inch, allowing this to escape through a plug in the top cover, and finally repeating the operation through a drain cock at the bottom. This was found to be quite effectual.

In the tabulated series it will be noticed that the products of combustion are always taken after an explosion of a pure mixture.

Fig. 4 shows the diagrams corresponding to the numbers in the tables for a richness 0.067, and the similarity between these and those in Fig. 2 bears out the conclusion that the addition of "burnt" products is, under these circumstances, equivalent to the addition of gas.

The exact position of the "shelf" is found to depend on the composition of the gas, and is probably determined by the percentage of free hydrogen and olefines. Although these results present certain features different from those obtained by Mr. Grover, the experiments are in general agreement.

Since Mr. Grover regarded procucts of combustion as "neutral gases," these were probably taken after any explosion instead of always after an explosion of a pure mixture. This is quite sufficient to account for the differences referred to, but without knowing the exact order of his experiments, it is impossible to give a detailed explanation.

Fig. 1. INITIAL PRESSURE. 1 ATMOSPHERE.

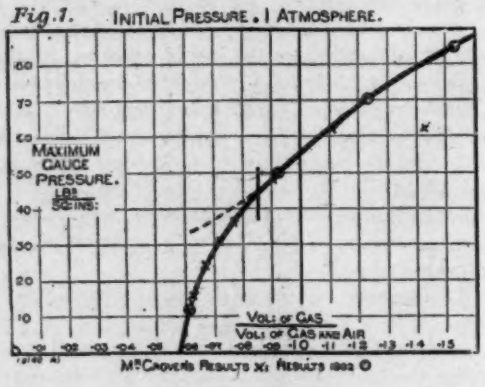


Fig. 3. AMOUNT OF COMBUSTION

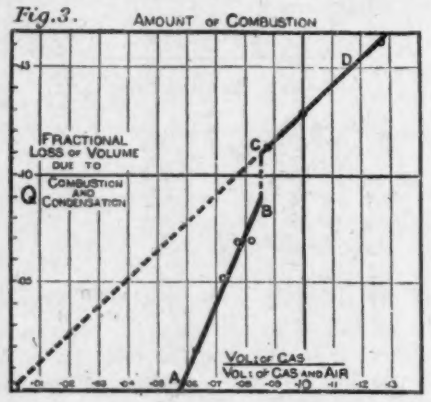


Fig. 2. EXPLOSION CURVES INITIAL PRESSURE: 40 GAUGE

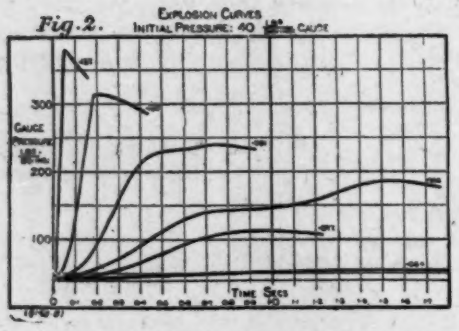
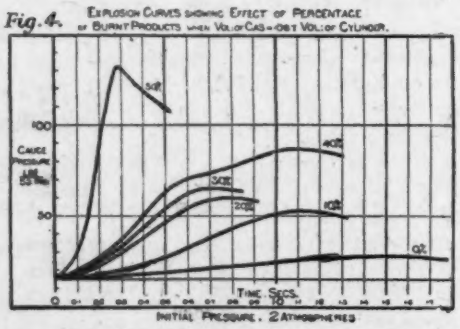


Fig. 4. EXPLOSION CURVES SHOWING EFFECT OF PERCENTAGE OF BURNT PRODUCTS WHEN VOL OF GAS = 067 VOL OF CYLINDER.



Some Phenomena of the Adhesion of Steel and Concrete.

J. W. Schaub, in a lecture on the subject of "Reinforced Concrete," before the Armour Institute, Chicago, remarked that when a bar of iron is inserted in a fresh mortar of cement, the cement will at once attack the iron, provided the latter is free from dirt, oil or grease, and that all mill scale has been removed. If the mortar is allowed to set it will be found that a chemical combination has taken place between the surface of the metal and the cement. If the bar was bright, before coming in contact with the cement, it will be found dull in lustre after the metal is exposed by removing the cement. The bar will, moreover, be found to have increased in weight, depending upon the length of time it has been inserted in the cement. M. Breuillie measured the increase in weight on thin plates, 2 by 2 inches, and found, after 76 days, an increase of about 12 milligrams in weight, depending upon the length of time the metal was exposed to the mortar.

If a soluble salt had formed, the plates taken out from the mortar should lose weight under the action of water. This was found to be the case. After six hours the loss of weight was about 2 milligrams; and, after a second immersion of seven hours the loss was 2.2 milligrams. From an analysis of these plates the increase in weight appears to be due to the formation of silicate of iron.

If the bar had been rusty before inserting in the mortar it would have been found, at the end of 15 to 20 days, perfectly free from rust, so that it appears the iron has given up its oxygen to the cement. Moreover, the cement, being anhydrous and alkaline in its reaction, will prevent the formation of rust; so that a coating of cement mortar should be, from a chemical and physical standpoint, an absolute protection against rust. This property of cement is taken advantage of in Europe, and quite recently in this country, in using it as a coating on iron where exposed to gases and other destructive agencies. The mortar is usually a mixture of 1 cement and 2 sand, applied with a brush as a wash. Five or six coats are applied in this way to give the metal a proper coating. This especially applicable in the case of the ironwork exposed in roundhouses, where the gases from locomotives are so destructive, and where paint is so inefficient.

It has generally been assumed that concrete, when coated with a rich mixture of mortar, is impervious to water. In order to obtain definite information on this subject, M. Breuillie undertook a series of experiments, which are described in a recent issue of the *Annales des Ponts et Chaussees*. Four slabs of reinforced Portland cement concrete were made, in which the proportions were as follows:

	1.	2.	3.	4.
Cement, pounds	1,323	1,323	1,764	2,204
Sand, cubic feet	12.6	12.6	12.6	12.6
Gravel, cubic feet	31.8	31.8	31.8	31.8

All slabs were 36 by 39 by 11.8 inches. The steel consisted of $\frac{5}{16}$-inch wires arranged as follows: About $\frac{3}{4}$-inch from the upper face there was placed a network of wires having a mesh about $1\frac{1}{2}$ inches square; this was followed by five other layers at intervals of $1\frac{1}{2}$ inches, except that the third and fourth layers were 4 inches apart. On top of the first layer a netting of $\frac{3}{32}$-inch wire netting was laid, and the mortar was pressed on it so as to form a dense coating. Six manometer tubes were inserted in each slab, so that each layer of wire was reached by one tube for the purpose of recording the permeability of the concrete. The first slab was subjected to a pressure of 39.4 feet of water in the morning, which was taken off in the evening. This operation was repeated for six consecutive days. The tubes showed that the water had penetrated the slab completely, and had reached the imbedded steel.

After this, the slab was left in the open air exposed to the weather, and from time to time pieces of the concrete were removed.

The edges of the slab were waterproofed by means of asphalt, so that water could not enter the slab except from the top. Upon removing the concrete, the metal was found in perfect condition, the mortar adhering to the metal near the edges of the slab protected with asphalt; whereas, in the interior of the slab, where the water was free to circulate, it did not adhere. In other words, the water had destroyed the bond between the mortar and the steel. The water was sampled before and after passing through the slab, and the analysis shows that the water just before passing into the slab, after removing the pressure, contained more cement salts than the water which passed through the slab.

The three remaining slabs were subjected to a water pressure of about 50 feet; but, in spite of the rich mortar used, all three specimens being as dense as the best granite, the water penetrated all of them, after having been subjected to intermittent pressures. As before, when the slabs were broken, it was found that the mortar did not adhere to the metal in the concrete through which the water passed. It has been shown that a chemical union takes place between the iron and the cement, and it has also been shown that this union is dissolved in water, so that when it becomes necessary to rely upon this bond to preserve the integrity of any reinforced concrete structure, which is exposed to the action of water, it becomes necessary to make the concrete impervious to water.

The salt which is formed at the surface of the metal determines the amount of adhesion between the metal and the mortar. This adhesion depends directly upon the superficial area of metal exposed to the action of the mortar. In addition to this adhesion the concrete, when allowed to set in air, contracts violently and grips the metal, so that two distinct actions take place when any metal reinforcement is introduced in a mortar about to set. The one is chemical and takes place at the surface of the metal; the other is physical and is produced by the shrinkage of the concrete. These actions are entirely distinct and independent of each other, and one may take place without the other. For example, a wide, thin plate may be coated all over with mortar, and obtain its greatest adhesion in the mortar, whereas, this same plate, when inserted in a mass of concrete may not be gripped at all by the shrinking concrete, owing to its peculiar cross section. On the other hand, a bar may be painted before inserting it in a mass of concrete, so as to preclude the possibility of any chemical action, and still be gripped by the concrete. This has actually been done, strange as it may seem, on some important work. In other words, in order to obtain the greatest adhesion the metal should be wide and thin, and in order to obtain the greatest grip the cross section of the metal should be either round or square.

In order to measure this adhesion, M. Breuillie prepared 30 plates 1¾ by 2¾ inches, which he stuck on the top of a fresh bed of mortar of 1 cement to 2 sand. This was left to harden in a room under ordinary conditions. The plates were then lifted off in series, the first series after two days, the rest after five days. The tests were made so that only the adhesion was measured, and no friction or sliding could take place between the contiguous surfaces. The average results of each series were as follows:

Contact Period, Days.	Average Adhesion, Pounds per Square Inch.	Contact Period, Days.	Average Adhesion, Pounds per Square Inch.
2	4	17	16.2
7	9.5	22	18.5
12	13.5	27	18.8

The conclusio vere that the adhesion increased uniformly and reached its gr value after 30 days of 22 pounds per square inch.

It has be hat water will destroy this adhesion. It can also be shown t destroy it. If a bar of iron surrounded with concrete be a temperature above 1,000° F., the water of crystallization i crete will be driven off, and if this temperature reaches the metal t concrete will break off. This is an important consideration in the fireproofing of iron or steel with concrete, and is governed by the nature of the concrete and its thickness. This subject should receive investigation, as it played an important part in the late Baltimore fire.

The next consideration should be the grip of the metal due to the shrinkage of the concrete. This shrinkage takes place in all concrete allowed to set in air. If it is allowed to set in water the reverse of this takes place and the concrete expands. It follows that the metal inserted in the concrete must contract and expand with the concrete. In other words, the metal will receive an initial stress.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, June 10th, 1904.

High Pressure.—The Institution of Gas Engineers.—A New Use for Breeze.

There is a marked tendency at present towards higher pressures for gas distribution. The days of 6-tenths and evenings of 10-tenths pressure are long passed and with the general adaptation of atmospheric burners for cookers or gas fires, and incandescent burners it is becoming evident that the consumers requirements are not to be covered at much less than 20-tenths on his side of the meter. This means running a much higher pressure on the street main system than has hitherto been considered necessary or desirable, and also a retort to the aid of mechanical power in the first place. The weight of the holder, which has done duty in the past as the prime mover for distribution, is no longer sufficient. The continual increase in the use of gas for purposes other than lighting has led up to a position, in many districts, which can only be met by increased pressure, or by increased size of mains. The latter, it need hardly be said is a big order, involving not only a large outlay, but all sorts of troubles with the customers and with the public authorities and, therefore, by common consent the managers of gas works turn to the question of higher pressures.

The article on distributing gas at a pressure of 25 pounds per square inch which appears in the *Gas World* for 28th May is therefore opportune. The author is Mr. Geo. Helps, of Nuneaton, who commences by summarizing the progress made in the United States, next gives a plain statement of the various considerations involved, and concludes with a detailed account of an installation comprising 5 miles of pipe and supplying 60 customers, which is claimed to be the first high pressure system on or near American lines that has been introduced into Europe. This is correct so far as Britain is concerned, but a high pressure system comprising 12 miles of pipe has been in operation in Germany for some time. The elaborate statement of the pros and cons will come as a surprise to many who have been accustomed to look at the question as one of pressure only, whether the joints will be strong enough, to the risk of bursting meters or blowing hydraulic seals. In the first place attention is directed to the large increase of "duty" obtainable at higher pressure, which is so marked that various extraneous mechanical methods for obtaining high pressure have been introduced. Of the disadvantages the only one regarded as of real importance is the effect on the bulk of the gas. If measured at a pressure of 30 pounds per square inch, *i. e.*, and double atmospheric pressure, 2 feet of gas would only figure out as one, and suggestions are made for meeting this difficulty. A practical test was made with a length of 3-inch steel pipe 4,250 yards along, and the result is interesting as substantiating the American experiences to the effect that Dr. Pole's formula, while fairly accurate at ordinary low pressures, falls very far short when we deal with over 10 pounds per square inch. At 5, 10 and 18 pounds per square inch respectively, Dr. Pole's formula would give approximately 5,950, 8,400 and 11,300 cubic feet per hour, but the actual tests showed 5,700, 9,600 and 18,000 cubic feet. Therefore, the usual rule that the delivery increases in proportion to the square root of the pressure is altogether out of it when we exceed 10 pounds per square inch. It is more like an increase in equal proportion.

One advantage that will follow in the wake of the cheaper distribution rendered possible by the high pressure system, will be a very important increase in the consumption of gas, rendered possible by the delivery of gas at town prices into outlying districts where, if used at all, it is at present supplied from a small local works, at a price and of a quality that tend towards a very limited consumption. The limit of low pressures and cast pipes is reached at a very few miles. But with the high pressure system it is as easy to deliver at 15 or 20 miles distance as to carry 3 or 4 miles at ordinary low pressure. Let us hope that the Nuneaton first will soon be followed by a respectable second of such proportions as to attract attention to the capabilities and possibilities of high pressure.

The meeting of the Institution of Gas Engineers was held in London this week closing to-day with the usual annual excursion. The list of papers was not a long one, but the quality was good, and the time usually allotted to the meetings was profitably spent. There were no lame horses, but each contribution touched upon a topic of general interest, and for this the Institution is probably indebted in no small measure to the foresight and energy of the President, Mr. H. E. Jones. His guiding hand was evident in more than one paper. He was evidently determined to get together a presentable programme and

further to see that it was properly appreciated by the members. In this praiseworthy endeavor, it is hardly necessary to state he was ably supported and assisted by the Honorary Secretary Mr. J. W. Helps, the Secretary Mr. W. T. Dunn and the executive, with the satisfactory result that there was not a dull moment from beginning to end, and the attendance was well maintained. Every member probably comes up on the first day determined to sit out the whole proceedings. But alas! Human nature is frail and the attractions of the Metropolis are many. Almost everybody has relatives in London and if a party including ladies call and ask for Mr. Retort or Mr. Gasholder and suggest an immediate and unofficial adjournment to one of the numerous resorts of amusement in the neighborhood, it is difficult to say, no! Even without such inducements the weather was tempting enough to lead one to think at a comparatively early hour in the day that they had had enough of it and that a stroll in the Park or on the embankment would be acceptable.

The President delivered a characteristically able and versatile inaugural address, after which Mr. Alfred Colson, of Leicester, described his 10 years' experience with the slot meter, making a very able presentment in favor of that appliance. The discussion that followed was much on the same lines. Very little was said on the question of stops versus slots, alluded to in my last month's letter. Mr. David Terrace followed with some account of his experiences at Middlesbrourg, with a gasholder tank on a marsh, which included an inexpensive and ingenious method of assisting a tank that tends to settle unevenly, to right itself. But after reading the "experiences" most engineers will agree that the better plan is to make sure of a firm site at the outset. Then there was a high-class lecture, with diagrams and experiments delivered by Prof. Harold B. Dixon, on the mechanism of construction, which was followed with close attention, and proved not only interesting but most instrucive. Dr. Colman gave a description of a form of tar extractor designed by himself for removing every vestige of tar fog from the gas, which was simple, cheap, and had no small orifices or screens that would become choked sooner or later, and usually sooner. In reply to the criticism that it was a mistake in principle to extract all the tar at an early stage and thus lose the benefit of the solvent action on naphthaline, Dr. Colman replied that the solvent action was a doubtful blessing that extended beyond naphthaline to the illuminants. The installation and working of the De Brouwer stoking machinery at Derby were exhaustively dealt with by Mr. J. Ferguson Bell, who made a very good showing in its behalf. The paper on the flow of gas in mains and distribution at high pressure was a masterly presentment on a subject which has been greatly neglected, and respecting which there is an absence of anything approaching accurate information. The practice in regard to distributing mains has run too much in the direction of the lines adopted by the nigger when he bought his shoes. He had the biggest pair in the shop at the price he was prepared to give, and similarly the science of distributing has not gone much beyond taking care to have the mains large enough. So much was this the case in years gone by that there are works that have more than doubled the output in the last 15 or 20 years, and yet have not felt the need of enlarging the main arteries leading off from the works. Prof. Unwin showed that the accepted traditions are incomplete and incorrect, and his paper will be filed as a valuable reference, especially in regard to the questions of high pressure to which I have already alluded. Mr. Broadberry had some valuable suggestions to make on a question that becomes rather acute in our large towns where a large number of public utilities require the use of the subsoil, and where sewage, gas, water, electricity, steam, etc., sometimes interfere with each other. His plan is to adopt a standard design for each width of road from which the position of any one service would be evident at a glance. Mr. W. Sugg submitted some very able considerations on a subject that is becoming important and that is the effect of the increasing standard of artificial light upon the public eyesight. Our grandmothers made fine lace and our grandfathers read small print, by the light of a single candle. Later on a rule of one candle at one foot distance came into vogue as an illustration of sufficient artificial light. But the public ideas on this point are now quite fourfold. The shops use a profusion of light, with the result that a similar degree of illumination is demanded in our offices, selling rooms and public halls. Mr. Sugg is no alarmist when he pleads for a careful study of natural conditions and an application of the same to artificial lighting.

Mr. W. R. Herring, of Edinburgh, having seen in a works in France a plan for preventing sliding of coal in inclined retorts consisting simply of mixing about 5 per cent. of coke dust or breeze with the coal, has been led to experiment further on the line suggested, not as a cure for slipping because he is fortunately free from that trouble, but as a means of getting rid of an almost valueless residual. He finds that from 5 to 15 per cent. of the material may be mixed with the coal before charging without prejudice to the quality of the coke, and that the evolution of gas is somewhat facilitated, enabling a heavier charge to be worked off in the same time. It would, therefore, appear that there are both financial and technical advantages in the plan. It is so simple as to admit of a ready trial on any works, and the benefits last named would apply to horizontal as well as to inclined retorts. If breeze at 2s. per ton can be converted with coke worth 12s. not only without prejudice to the carbonizing operations but to the advantage of the same, it is obviously more profitable to send the breeze into the retort house than to sell it at a take it away price, and that irrespective of the angle at which the retorts happen to be set.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. Frank W. Frueauff has been appointed General Manager of the Denver (Col.) Gas and Electric Company. He deserves his promotion.

The formal transfer of the plant and business of the Norwich (Conn.) Gas and Electric Company to the authorities for operation on public account will be made the 1st prox.

Mr. R. B. Steward, the clever Vice-President of the D. M. Steward Mfg. Co., of Chattanooga, Tenn., writes us that the Company is adding constantly to its lines of heat resisting parts for incandescent burners. He calls attention to the fact that the "parts" are known as "lavite," a patented material, the claims for which in the main are that it is anti-corrosive and only slightly susceptible to the action of heat. The lines include caps which are used as substitutes for wire gauze caps; center supports for mantles of all sizes and lengths; hollow rods for covering the side wires to prevent the latter from bending; pilot tips for arc lamps, and many other special pieces along the line indicated.

Send to Mr. W. A. Stadelman, Manager of the Brown Hoisting Machinery Company, for a packet of the Brownhoist crane cards, similar to those the concern is giving away to those who visit the Company's exhibit in the Machinery Building, World's Fair, St. Louis.

Mr. F. R. Rea, of Des Plaines, Ills., is striving to secure a franchise for the right to manufacture and supply gas in Barrington, Ills. He offers to sell gas at the uniform rate of $1.25 per 1,000 cubic feet until such time as the annual output reaches 20 millions cubic feet, when the price will be put at $1 per 1,000. This looks like a safe proposition from Mr. Rea's point of view.

It is reported that Mr. T. C. Bates, of Worcester, Mass., is endeavoring to consolidate the lighting, water supply and ice manufacturing industries of Beaumont, Tex.

A correspondent in Boston, Mass., writing under date of the 20th inst., says: "A petition was filed last week in the Supreme Court for the appointment of a Receiver for the Arlington (Mass.) Gas Light Company. The active agent in the proceedings is Mr. Alfred V. Lincoln, who holds a note for $2,500 against the Company. He alleges that other notes aggregating $60,000 are outstanding, some of which are overdue, and urges that the Company instead of being solvent is insolvent. Sherman L. Whipple, Counsel for the Company, says that it did not authorize the note and that it did not receive any money on account thereof. He also asserted that the other notes are of a parity to that held by Lincoln.

Superintendent Andrews, of the Hamilton (O.) municipal gas plant, according to figures presented about a fortnight ago, shows that the plant cost the city a loss of $10,000 for the past twelvemonth.

At the annual meeting of the shareholders in the New Brunswick (N. J.) Gas Company, the officers chosen were: Directors, J. C. Eisele, Nathaniel King, H. B. Barret, R. V. Johnson, W. P. Voorhies and J. B. Fitzpatrick; President, J. B. Fitzpatrick; Treasurer, J. C. Eisele.

Mr. Guy K. Dustin, formerly in the employ of the Peoples Gas Light and Coke Company, of Chicago, Ills., has been appointed Superintendent of Works to the Hartford City (Conn.) Gas Light Company.

THE capital stock of the Belfast (Me.) Gas and Electric Company, the headquarters of which are in Portland, Me., has been increased to $115,000.

THE franchise rights granted by the village trustees of Bennington, Vt., two years ago, to the projectors of the Bennington Gas Company, have been extended for a period of two years. It is said that the franchise is held by those who have bern instrumental in putting gas into Barre, Vt.

OUR contemporary *Electricity* naively reports that "A bakery, the heat for which is generated electrically, has recently been put in operation in Montauban, France. The conversion has been carried out without any essential alterations in the construction of the oven, and heating by wood may be reverted to whenever necessary!" "Heating by wood may be reverted to whenever necessary!" Aye; there's the rub!

"L. J. T.," WRITING from Chicago under date of the 18th inst., says: "There is some, if not material, doubt as to whether the gas ordinance recently passed by the Quincy (Ills.) City Council, giving corporate life to the Independent Gas Company, of Quincy, for a period of 50 years, will ever amount to anything practically. Under the provisions of the grant the Company may charge not to exceed $1 per 1,000 cubic feet, and it must pay into the city treasury 2 per cent. per annum on its gross receipts."

MR. FERRIER has at last gained his point, that the Gas Light Company, of Columbus, Ga., should not allow the adjoining district of East Highlands to remain longer dormant as a producer of gas revenue. In other words, he has persuaded his Directors that it would be a profitable scheme to extend the Columbus Company's mains to the East Highland district.

ADVICES by way of Brooklyn, N. Y., are to the effect that some days ago a 50-year franchise was granted to the Queens Borough Gas and Electric Company, of Far Rockaway, L. I., by the Board of Supervisors of Nassau county, to lay mains, erect poles and string wires under and over county roads in the town of Hempstead, for the purpose of furnishing gas and electricity to the residents for their use as lighting, power and heating mediums. The Company is required to give a bond for $2,000, and to pay $3 per diem for inspection daily, as a guarantee of and payment for the task of seeing to it that the highways are restored to their original condition when the work of putting down the mains is at an end."

THE Edison Company, of Boston, seems to be anxious to acquire the right to take over the gas and electric lighting supply of Waltham, Mass. The Waltham street car lines are also involved in the proposed deal.

EARLY this month the members of the Louisiana Engineering Society, at the invitation of Mr. Thomas D. Miller, Manager of the New Orleans Lighting Company, visited the Company's plant in South Robertson street, and thoroughly inspected the same, the guide and lecturer being Manager Miller. The inspection was fittingly closed by the serving of a delicious luncheon, which was "cleaned up" in the department of the plant known now as the all slave headquarters.

WE are indebted to a Boston (Mass.) correspondent for the following, dated Boston, Mass., June 16th: "At meetings of the Directors of the Boston Gas Light Company, Bay State (Mass.) Gas Company, Roxbury Gas Light Company and South Boston Gas Light Company to-day the following dividends were declared: Boston Gas Light Company, 5 per cent.; Bay State Gas Company, 5 per cent.; Roxbury Gas Light Company, 5 per cent., and South Boston Gas Light Company, 3 per cent., payable June 30 to stockholders of record June 27. Mr. James L. Richards, who is President of this group of Companies, recently was elected President of the Brookline, Dorchester and Jamaica Plain Gas Light Companies and also of the Massachusetts Pipe Line Company. Previous to to-day's declarations the last dividends paid by the Boston Gas Companies (the so-called Addicks Companies) were December 31, 1901. To-day's dividends compare with those of December, 1901, as follows:

Company.	To-day's Dividend. Per Cent.	Dec., 1901. Per Cent.
Boston	5	6
Roxbury	5	3½
Bay State	5	5
South Boston	3	2

"The amount of these Gas Company stocks held by the Massachusetts Gas Companies and to-day's dividends to which they are entitled are as follows:

Company.	Shares Held.	Rate. Per Cent.	Payment.
Boston	4,987	5	$124,675
Roxbury	5,986	5	20,930
Bay State	19,986	5	99,430
South Boston	4,376	3	13,128
Total			$267,663

"In addition to the dividends declared by the Boston, Bay State, Roxbury and South Boston Gas Light Companies to-day ($268,200) the other Gas Companies in the Massachusetts Gas Companies have declared quarterly dividends as follows, payable June 30:

Company.	Rate. Per Cent.	Amount.
Massachusetts Pipe Line Co.	1¼	$12,500
Brookline Gas Light Co.	2½	50,000
Jamaica Plain Gas Light Co.	2½	6,250
Dorchester Gas Light Co.	2½	12,990
Total		$81,740

"Assuming that the dividends on the Boston Companies are semi-annual, although it is not so stated, and that the Brookline Companies will pay the same amount for the full year, the total annual income of the Massachusetts Gas Companies from its ownership of stock in the Boston, Bay State, of Massachusetts, Roxbury, South Boston, Brookline, Dorchester, Jamaica Plain and Massachusetts Pipe Line Gas Companies would be $861,920. This does not include the profits resulting from the operation of the New England Gas and Coke Company or the other Companies owned."

THERE is good reason for doubting that the authorities of Elgin, Ills., are disposed to grant the franchise asked for by the projectors of the National Gas Company for Elgin. The general feeling amongst the residents is that they have been fairly treated in the matter of their gas supply by the owners of the Elgin American Gas Company.

AT the election held some days ago in Oelwein, Ia., to determine whether or not the authorities should grant a franchise for the operation of a gas works there, those who favored the project greatly outnumbered those who opposed it.

CONSTRUCTION work on the Lead-Deadwood (So. Dak.) Gas Company is well underway, especially so in respect of the main system. The initial mileage of the latter is put at 9.

A CORRESPONDENT in Kansas City, Mo., forwards the following:

"At a recent meeting of the special gas committee of the City Council, of Lincoln, Neb., with President Doherty and Manager Honeywell, of the Lincoln Gas and Electric Light Company, an amicable compromise was arranged by the terms of which the Company is to reduce the price of both fuel and illuminating gas in the city on the 1st of October, 1904, to $1.20. This will be the net price for both kinds of gas after that date, and but one meter will be used. This is a reduction on lighting gas of 26¼ cents per 1,000 net, and in fuel of 5 cents. Until that date the present prices of $1.46¼ and $1.25 will remain in force. When Mr. Doherty was here he told the committee that he had not received any replies from the men most interested in the Company and asked for time until he could go East and talk the matter over with them. When he reached St. Joseph yesterday (June 14) he found replies from them in which they stated that, while they did not wish to quarrel with the city, they could not, because of what it meant to them financially, agree to go below $1.25. Mr. Doherty communicated this fact to the committee. The members were insistent upon getting a reduction for consumers of both lighting and fuel gas, and they finally made the proposition that the present price should stand until October 1st, after which $1.20 should go into effect for both kinds of gas. The committee will make a report to the Council recommending that this be agreed to, as the best thing for the city at this time."

THE manufacturing plant of the Guthrie (Okla.) Gas Light and Fuel Company will be in operation by July 10th. The Company is establishing handsome and commodious offices in the Bamford Building, and Manager Craig asserts that the enterprise is bound to be a paying one from the start.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JUNE 27, 1904.

The Market for Gas Securities.

The feature of the stock market last week was the increase in the nominal values for Consolidated gas stock and the better markings made in respect of the "right" to subscribe to the new bond issue. Ordinary stock sold up to 197 and a fraction, and the "rights" went above 18. To-day (Friday), at the closing, the returned official values were: Stock, 194¾ to 195; "rights," 17 to 17⅞. Some of the real speedy thinkers, who figure much better than they know, have amused those close to the throne with the suggestion that the dividend rate was to be increased to 10 per cent. per annum next quarter. The rate will not be increased an iota. Take advantage of the bond issues of one sort and another. Don't call your "rights," but exercise them. The electric end of the concern is becoming a trifle topheavy. It will need the expenditure of much money to keep it in presentable shape. Meanwhile, do not lose sight of the fact that Consolidated ordinary shares are cheap.

Brooklyn Union is slow and dull, the quotations (212 to 220) being merely nominal, and they are at least 25 points below the real value of the shares. Baltimore Consolidated is 71¾ to 72, and Peoples, of Chicago, is 98 bid. Our item columns for the week contain some mention of recent dividends on certain Boston controlled gas shares. There does not seem to be much enthusiasm over the Rochester (N. Y.) re-financing scheme.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JUNE 27.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	194¾	195
Central Union, Bonds, 5's.	3,000,000	1,000	106½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	270	300
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	105½	106
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	31	..
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	..	..
Northern Union, Bonds, 5's.	1,250,000	1,000	102¾	105½
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109¾	111
" 1st Con. 5's	1,500,000	..	106	108
Standard	5,000,000	100	125	13
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	999,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	212	220
" " Bonds (5's)	15,000,000	1,000	113	115
Bay State	50,000,000	50	3/16	3/16
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works..	450,000	100	28	30
" 1st Mtg. 5's	500,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	3¾	4
" " Bonds, 5's	5,250,000	1,000	12¾	..
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	102¾	103⅛
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¼	89¼
Preferred	3,096,500	100	107⅛	109
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	71¾	72
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	86	90
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,003,000	1,000	99½	100
Detroit Gas Co., 5's	351,000	1,000	75	75¼
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	67	68
" Bonds, 5's	10,500,000	..	103½	104½
Indianapolis	2,000,000	..	60	70
" Bonds, 6's	2,650,000	..	103½	106½
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	90	100
Preferred	2,500,000	100	80	100
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	138	140
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	64	70
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	98	98¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	.
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58¼	58¾
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	92	94½
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's..	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047,000	1,000	94	96
Washington, D. C	2,500,000	20	285	287½
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	.	..	..
Wilmington, Del	600,000	50	230	..

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, New York City....1032
Baxter & Young, Detroit, Mich....1032
B. E. Chollar, St. Louis, Mo....1018
David Leavitt Hough, New York City....1032
Economical Gas Apparatus Construct'n Co., Toronto, Ont.1024
Frank D. Moses, Trenton, N. J....1019
Fred. Bredel Co., Milwaukee, Wis....1020
Frederic Egner, Washington, D. C....1018
Geo. G. Ramsdell, New York City....1017
Geo. R. Rowland, New York City....1022
Humphreys & Glasgow, New York City....1033
J. F. W. Jost, Philadelphia, Pa....1017
Kerr Murray Mfg. Co., Fort Wayne, Ind....1032
The Gas Machinery Co., Cleveland, O....1030
The Jeffrey Manufacturing Co., Columbus, O....1030
The Western Gas Construction Co., Fort Wayne, Ind....1040
United Gas Improvement Co., Philadelphia, Pa....1027
Wm. Henry White, New York City....1035

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City....1032
Bartlett, Hayward & Co., Baltimore, Md....1033
Baxter & Young, Detroit, Mich....1032
Connelly Iron Sponge and Governor Co., New York City1029
Continental Iron Works, Brooklyn, N. Y....1034
Cruse-Kemper Co., Philadelphia, Pa....1019
Davis and Farnum Mfg. Co., Waltham, Mass....1032
Daily & Fowler, Philadelphia, Pa....1036
Economical Gas Apparatus Construct'n Co., Toronto, Ont.1024
Frank D. Moses, Trenton, N. J....1019
Fred. Bredel Co., Milwaukee, Wis....1020
G Shepard Page's Sons, New York City....1032
Humphreys & Glasgow, New York City....1033
Isbell-Porter Company, New York City....1034
Kerr Murray Mfg. Co., Fort Wayne, Ind....1032
Lloyd Construction Co., Detroit, Mich....1022
Logan Iron Works, Brooklyn, N. Y....1036
Quinlard Iron Works, New York City....1033
R. D. Wood & Co., Philadelphia, Pa....1034
Riter-Conley Mfg. Co., Pittsburg, Pa....1035
Stacey Mfg. Co., Cincinnati, O....1035
The Connersville Blower Company, Connersville, Ind...1037
The Gas Machinery Co., Cleveland, O....1030
The Jeffrey Manufacturing Co., Columbus, O....1030
The Western Gas Construction Co., Fort Wayne, Ind....1040
United Gas Improvement Co., Philadelphia, Pa....1027

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md....1033
B. E. Chollar, St. Louis, Mo....1018
Economical Gas Apparatus Construct'n Co, Toronto, Ont 1024
Fred. Bredel Co., Milwaukee, Wis....1020
Humphreys & Glasgow, New York City....1033
The Gas Machinery Co., Cleveland, O....1030
The Western Gas Construction Co., Fort Wayne, Ind....1040
United Gas Improvement Co., Philadelphia, Pa....1027

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N.Y....1034
Economical Gas Apparatus Construct'n Co., Toronto, Ont.1024
Fred. Bredel Co., Milwaukee, Wis....1020
Kerr Murray Mfg. Co., Fort Wayne, Ind....1032
Logan Iron Works, Brooklyn, N. Y....1036
R. D. Wood & Co., Philadelphia, Pa....1034
Riter-Conley Mfg. Co., Pittsburg, Pa....1035
Stacey Mfg. Co., Cincinnati, O....1035
The Gas Machinery Co., Cleveland, O....1030
The Western Gas Construction Co., Fort Wayne, Ind....1040

PRODUCER POWER PLANTS.
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 1024
R. D. Wood & Co., Philadelphia, Pa. 1034

TAR AND CARBONIC ACID EXTRACTOR.
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 1021
Fred. Bredel Co., Milwaukee, Wis. 1020
Stacey Mfg. Co., Cincinnati, O. 1035
The Gas Machinery Co., Cleveland, O. 1020
The Western Gas Construction Co., Fort Wayne, Ind. 1040

AMMONIA CONCENTRATORS.
Fred. Bredel Co., Milwaukee, Wis. 1020
Michigan Ammonia Works, Detroit, Mich. 1015
The Gas Machinery Co., Cleveland, O. 1020
The Western Gas Construction Co., Fort Wayne, Ind. 1040

GAS METERS.
American Meter Co., New York and Philadelphia. 1039
Detroit Meter Company, Detroit, Mich. 1039
D. McDonald & Co., Albany, N.Y. 1037
Helme & McIlhenny, Philadelphia, Pa. 1039
John J. Griffin & Co., Philadelphia, Pa. 1000
Keystone Meter Co., Royersford, Pa. 1038
Maryland Meter and Mfg. Co., Baltimore, Md. 1038
Metric Metal Co., Erie, Pa. 1039
Nathaniel Tufts Meter Co., Boston, Mass. 1038

PREPAYMENT METERS.
American Meter Co., New York and Philadelphia. 1039
D. McDonald & Co., Albany, N. Y. 1037
Helme & McIlhenny, Philadelphia, Pa. 1039
John J. Griffin & Co., Philadelphia, Pa. 1000
Keystone Meter Co., Royersford, Pa. 1038
Nathaniel Tufts Meter Co., Boston, Mass. 1038

PREPAYMENT METER ATTACHMENTS.
Reeves Mfg. Co., New Haven, Conn. 1020

GAS AND WATER PIPES.
Davis & Farnum Mfg. Co., Waltham, Mass. 1032
Donaldson Iron Co., Emaus, Pa. 1024
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 1024
M. J. Drummond & Co., New York City. 1024
R. D. Wood & Co., Philadelphia, Pa. 1034
Warren Foundry and Machine Co., New York City. 1024

GAS COALS.
Berwind-White Coal Mining Co., New York and Phila. 1030
Perkins & Co., New York City. 1030
Westmoreland Coal Co., Philadelphia, Pa. 1031

SPECIALTIES FOR OIL AND PIPE LINES.
S. R. Dresser, Bradford, Pa. 1021

GAS MAIN STOPPERS.
Safety Gas Main Stopper Co., N.Y. City. 1024

MAIN AND SERVICE LAYING.
Sullivan Bros., Flushing, N. Y. 1020

GAS TAPPING MACHINES.
George Light, Dayton, O. 1034
H. Mueller Manufacturing Company, Decatur, Ills. 1017

CANNEL COALS.
Perkins & Co., New York City. 1030

STOKING MACHINERY.
G. A. Bronder, New York City. 1029

CONVEYORS.
Adam Weber Sons, New York City. 1028
C. W. Hunt Company, New York City. 1021
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 1024
Fred. Bredel Co., Milwaukee, Wis. 1020
G. A. Bronder, New York City. 1029
Kerr Murray Mfg. Co., Fort Wayne, Ind. 1032
The Brown Hoisting Machinery Co., Cleveland, O. 1031
The Gas Machinery Co., Cleveland, O. 1020
The Jeffrey Manufacturing Co., Columbus, O. 1030
The Link-Belt Engineering Co., Philadelphia, Pa. 1021
The Link-Belt Machinery Co., Chicago, Ills. 1024
The Western Gas Construction Co., Fort Wayne, Ind. 1040

CHARGING BARROWS & COAL WAGONS.
Kerr Murray Mfg. Co., Fort Wayne, Ind. 1032
Stacey Mfg. Co., Cincinnati, O. 1035

GAS ENRICHERS.
Standard Oil Co., New York City. 1031
Sun Company, Pittsburg, Pa. 1031
The Sun Oil Co., Pittsburg, Pa. 1031

COKE CRUSHERS.
C. M. Keller, Columbus, Ind. 1031
Fred. Bredel Co., Milwaukee, Wis. 1020
The Jeffrey Manufacturing Co., Columbus, O. 1030

STEAM BLOWER FOR BURNING BREEZE.
The Connersville Blower Company, Connersville, Ind. 1037

ECONOMIZERS.
Green Fuel Economizer Co., Matteawan, N.Y. 1022

GAS GAUGES.
The Bristol Co., Waterbury, Conn. 1022

GAS GOVERNORS.
Connelly Iron Sponge and Governor Co., New York City 1029
Fred. Bredel Co., Milwaukee, Wis. 1020
Isbell-Porter Co., Newark, N. J. 1034
R. D. Wood & Co., Philadelphia, Pa. 1034

CEMENTS.
C. L. Gerould, Bloomington, Ind. 1028

RETORTS AND FIREBRICKS.
Adam Weber Sons, New York City. 1028
Baltimore Retort and Firebrick Co., Baltimore, Md. 1028
Brooklyn Firebrick Works, Brooklyn, N. Y. 1028
Henry Maurer & Son, New York City. 1028
James Gardner, Jr., Co., Pittsburg, Pa. 1028
J. H. Gautier & Co., Jersey City, N. J. 1028
Laclede Firebrick Mfg. Co., St. Louis, Mo. 1028
Missouri Firebrick Co., St. Louis, Mo. 1028
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 1018
The Kreischer Brick Mfg. Co., New York City. 1028

INCLINED RETORTS.
Adam Weber Sons (Graham, Morton [England] System). 1028
Fred. Bredel Co., Milwaukee, Wis. 1020
Geo. G. Ramsdell, New York City. 1018
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 1018

VERTICAL S'S.
Adam Weber Sons (Oscar B. Weber's Construction). 1028
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 1029
Fred. Bredel Co., Milwaukee, Wis. 1020
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 1018

VERTICAL CHARGING & DISCHARGING MACHINERY.
Adam Weber Sons, New York City. 1028

REGENERATIVE FURNACES.
Adam Weber Sons, New York City. 1022
Bartlett, Hayward & Co., Baltimore, Md. 1033
Fred. Bredel Co., Milwaukee, Wis. 1020
J. H. Gautier & Co., Jersey City, N. J. 1028
Laclede Firebrick Mfg. Co., St. Louis, Mo. 1028
Missouri Firebrick Co., St. Louis, Mo. 1028
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 1018

SELF-SEALING MOUTHPIECE DOORS.
Continental Iron Works, Brooklyn, N.Y. 1034
Fred. Bredel Co., Milwaukee, Wis. 1030
Isbell-Porter Co., Newark, N. J. 1034
Kerr Murray Mfg. Co., Fort Wayne, Ind. 1032
Logan Iron Works, Brooklyn, N.Y. 1036
R. D. Wood & Co., Philadelphia, Pa. 1034
Stacey Mfg. Co., Cincinnati, O. 1035
The Gas Machinery Co., Cleveland, O. 1020
The Western Gas Construction Co., Fort Wayne, Ind. 1040

CHIMNEY CONSTRUCTION.
Adam Weber Sons, New York City. 1028

INCANDESCENT GAS LAMPS.
D. M. Steward Mfg. Co., Chattanooga, Tenn. 980
General Gas Light Co., Kalamazoo, Mich. 1019
Geo. G. Ramsdell, New York City. 1017
Welsbach Company, Gloucester, N. J. 1026

BURNERS.
D. M. Steward Mfg. Co., Chattanooga, Tenn. 980
Wm. M. Crane Co., New York City. 1021

LAVA GAS TIPS.
D. M. Steward Mfg. Co., Chattanooga, Tenn. 980

STREET LAMPS.
Thos. T. W. Miner, New York City. 1021
Welsbach Street Lighting Co., New York and Phila. 1026

PURIFIERS.
Connelly Iron Sponge and Governor Co., New York City. 1029
Fred. Bredel Co., Milwaukee, Wis. 1020
Kerr Murray Mfg. Co., Fort Wayne, Ind. 1032
R. D. Wood & Co., Philadelphia, Pa. 1034
Stacey Mfg. Co., Cincinnati, O. 1035
The Western Gas Construction Co., Fort Wayne, Ind. 1040

PURIFYING MATERIALS.
Connelly Iron Sponge and Governor Co., New York City 1029

(*Continued on page* 1016.)

DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., June 8, 1904.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable July 15th, 1904, to stockholders of record at the close of business, June 20, 1904. Checks will be mailed.

1514-5 LEWIS LILLIE, Treasurer.

WANTED,

A Bright, Reliable, Competent Young Man,

Familiar with the purification of gas. Steady position to the right party.

1515-2 Address, "INTELLIGENT," care this Journal.

WANTED.

A position in a gas company is open for a gentleman who is thoroughly familiar with branch office detail; a systematizer possessing tact, ability and knowledge of accounts; one who can get the best results out of a large branch office force. Preference will be given to the applicant who has had experience in the credit department of a gas company. This is an excellent opening for a good man. State age, experience, references, and salary expected.

1516-4 Address, "X. Y. Z.," care this Journal.

FOR SALE.

Complete Gas Plant, Discarded because Outgrown.

Forty-two Mouthpieces, 19 inches by 12 inches.
Forty-two Standpipes.
Forty-two Bridgepipes.
Forty-two Dip Pipes.
Four Sections Hydraulic Main.
One P. & A. Tar Extractor, 8-inch connections.
One Rotary Scrubber, 10 sections; 10 inch connections.
Six Purifying Boxes, 8 feet by 13 feet by 3¼ feet; 10-inch connections.
Twelve 10-inch Valves; bell ends.
Five 10-inch Valves; flange ends.
One 4-Box Dry Centers-al Valve; capacity about 250,000 cubic feet per day.
Ells, Tees, Bends, Etc., to connect boxes.
A Large Assortment of Pulleys, Shafting, Etc.

Address,
NEW BEDFORD GAS AND EDISON LIGHT COMPANY,
1516-5 NEW BEDFORD, MASS.

FOR SALE.

One Section Wrought Iron Hydraulic Main, with 8tiness tar take-off, for 3 benches of 6's.
One Section Main, for 4 benches of 6's.
Standpipes, Bridgepipes, Mouthpieces with Self-sealing Lids, for 7 benches of 6's.
One Sinuous Friction Condenser.
One Walker Tar Extractor.
Four Purifiers, 10 by 16 by 3; complete. Connections above apparatus, 10-inch.
One 50 Horizontal Return Tubular Boiler.

All of the above apparatus is in good condition, and to be sold, as the company has been obliged to purchase larger for its new works. Address, TAUNTON GAS LIGHT CO.,
1514-6 Taunton, Mass.

FOR SALE.

Three Davis & Farnum Purifiers,

Twelve feet by 24 feet by 4 feet. Also,

One 50-Horse Power Bigelow Boiler.

All in good condition. Address,

PAWTUCKET GAS COMPANY,
1506-tf PAWTUCKET, R. I.

FOR SALE.

Lot of second-hand

THREE-LIGHT METERS,

in splendid condition; as good as new. Also one

NINE-FOOT STATION METER,

with a capacity of 1,000,000 cubic feet per 24 hours. Address, "VINDEX,"
1508-tf Care this Journal.

FOR SALE.

Gas Plant in Good, Growing Town,

Making good net profit now, and with practical gas man can be doubled and more.

1511-6 Address, "K.," care this Journal.

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.

IMPROVED AMMONIA CONCENTRATOR.

About 100 in use. Write to
STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS, Detroit, Mich.

(*Continued from page* 1015.)

VALVES.

Continental Iron Works, Brooklyn, N. Y.....1034
Economical Gas Apparatus Construct'n Co., Toronto, Ont 1024
Isbell-Porter Co., Newark, N. J.....1034
Kerr Murray Mfg. Co., Fort Wayne, Ind 1032
Ludlow Valve Manufacturing Co., Troy, N.Y.....1021
R. D. Wood & Co., Philadelphia, Pa.....1034
Stacey Mfg. Co., Cincinnati, O.....1035
The P. H. & F. M. Roots Co., Connersville, Ind.....1023
The Western Gas Construction Co., Fort Wayne, Ind... 1040

EXHAUSTERS.

Connelly Iron Sponge and Governor Co., New York City1029
Isbell-Porter Company, Newark, N. J.....1034
Kerr Murray Mfg. Co., Fort Wayne, Ind.....1032
The Connersville Blower Company, Connersville, Ind.. 1037
The P. H. & F. M. Roots Co., Connersville, Ind..... 1023

ELECTRICAL APPARATUS.

Wm. Henry White, New York City.....1035

PURIFIER SCREENS.

John Cabot, Hoboken, N. J.....1020

GRATE BARS.

F. Ferguson & Son, Hoboken, N. J. 1024

GAS STOVES.

American Meter Co., New York and Philadelphia.....1025
Detroit Stove Works, Detroit and Chicago.....1038
Keystone Meter Co., Royersford, Pa.....1038
Maryland Meter and Manufacturing Co., Baltimore, Md.1038
Nathaniel Tufts Meter Co., Boston, Mass.....1038

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich.....1016

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N.Y.....1022

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md.....1033
Continental Iron Works, Brooklyn, N.Y.....1034
Cruse-Kemper Co., Philadelphia, Pa. 1019
Davis & Farnum Mfg. Co., Waltham, Mass..... 1032
Deily & Fowler, Philadelphia, Pa.....1036
Economical Gas Apparatus Construct'n Co., Toronto, Ont.1024
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 1032
Logan Iron Works, Brooklyn, N Y.....1036
R. D. Wood & Co., Philadelphia, Pa.....1034
Riter-Conley Mfg. Co., Pittsburg, Pa.....1035
Stacey Mfg. Co., Cincinnati, O..... 1035

STORAGE TANKS.

Stacey Mfg. Co., Cincinnati, O.....1035

PAINTS.

National Paint Works, New York City.....1032

PATENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C..... 1020

BOOKS, ETC.

Scientific Books..... 1018
Self-Instruction for Students in Gas Manufacture 1030
Finances of Gas and Electricity Mfg. Enterprises 1021
Practical Handbook on Gas Engines..... ...1021
Gas and Gas Works.....1018
Electric Gas Lighting.....1024
Coal Tar and Ammonia..... 1030
Gas Analyst's Manual 1036
Field's Analysis, 1902..... 1016
Gas Flow Computers..... 1031
Excerpts from Reports of Gas Commissioners..... 999
Directory of Gas Companies..... 1035
Gas Engineer's Laboratory Handbook..... 1034
Gas Engineer's Pocket-Book.....1028
Poole on Fuels.....1031
Binders.....1031

THE SUMMER SEASON

Means More Hot Baths.

Furnish your consumers the easiest, quickest, cleanest and most economical means of securing Hot Baths by recommending or selling the

Humphrey Crescent Instantaneous Water Heaters.

Price, $16 to $45, GUARANTEED.

The No. 6, price $25, here illustrated, will heat three gallons of water per minute 50° in temperature, supplying a large family at any time with all the Hot Baths wanted.

We Make Quick Shipments.

Send to-day for prices to **HUMPHREY CO., Kalamazoo, Mich.**

COAL TAR AND AMMONIA.

THIRD AND ENLARGED EDITION.

BY

GEORGE LUNGE, PH.D.

Price, $15. For Sale by

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

FIELD'S ANALYSIS

For the Year 1902.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 34th Year of Publication.

COMPILED AND ARRANGED BY **JOHN W. FIELD,**

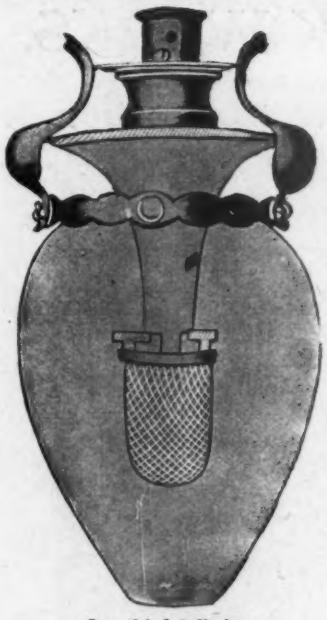
Secretary and General Manager of The Gas Light and Coke Company, London.

PRICE, $5. FOR SALE BY

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

The Latest Novelty in Gas Lighting is the

PATENT INVERTED INCANDESCENT GAS BURNER.



One third full size.
Price: Burner with Mantle and Globe, $2.50.

No. 1 BURNER.

The most up-to-date and economical system of gas lighting, artistic in appearance, absolutely shadowless, and readily attached to existing fittings.

A BRILLIANT WHITE LIGHT OF 65 STANDARD CANDLE POWER.

Gas Consumption only 3 Cubic Feet per Hour.

The decorative appearance of Electric Light at one-eighth the cost.

THE "BIJOU" BURNER

Is the nearest approach to Electric Light, and lends itself more than any other gas burner to private house lighting, having an exceedingly pretty effect, especially when fixed in clusters of two, three or five lights.

20 standard candle power.

Consumption of Gas, 1 foot per hour.

One-third full size.
Price: Burner with Mantle and Globe, $2.

The New Inverted Incandescent Gas Lamp Co., Ltd.,

GEO. G. RAMSDELL, Agent,

530 BROADWAY, - - NEW YORK.

MUELLER GAS MAIN TAPPING MACHINES.

C-0 0

For dry pipe tapping a low cost machine can be substituted for the high priced one used in pressure tapping, and the general wear and tear will be less expensive.

The Mueller "Regular" Tapping Machine is an ideal substitute to use in work of this kind. It is substantially made, and will do open tapping just as well as the most expensive machine.

Mueller Tapping Machines are made for open tapping, for tapping under pressure, and for tapping light weight pipes in which connections cannot be made without the use of a service clamp. The machine illustrated here is used for open tapping only. We also make gas cocks, meter connections and other accessories for gas works use.

Each tapping machine is given a test which is as near like actual service use as possible, and is *unconditionally guaranteed.*

Mueller Tapping Machines are on exhibit in the Palace of Manufactures, World's Fair.

H. MUELLER MFG. CO.,

DECATUR, ILL., U. S. A.

PARKER-RUSSELL MINING AND MFG. CO.,

OF ST. LOUIS, MO.,

PROPRIETORS OF THE

OAK HILL GAS RETORT AND FIREBRICK WORKS.

ST. LOUIS OFFICE: 417 Pine Street. NEW YORK OFFICE: Aldrich Court, 45 Broadway.

WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

SLOPERS.--We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

We Build Benches Complete. Ready for Gas Making. Also,

RETORT HOUSES,

COAL and COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates Cheerfully Furnished.

CORRESPONDENCE SOLICITED.

ALL CONTRACTS MADE AS OF ST. LOUIS, MO.

FREDERIC EGNER,

Gas Engineer,

NORFOLK, VA.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

SCIENTIFIC BOOKS.

ELECTRIC GAS LIGHTING. By H. S. Norrie. 50 cents.

GAS ANALYST'S MANUAL. By J. Abady. $6.50.

COX'S GAS FLOW COMPUTER. $2.50.

FIELD'S ANALYSIS, 1902. $5.

GAS AND GAS WORKS. By Hughes and O'Connor. $2.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor $3.50.

TECHNICAL GAS ANALYSIS. By Winkler & Lunge. $4.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

PRACTICAL TREATISE ON HEAT. By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

HEMPEL'S GAS ANALYSIS, $2.25.

SELF-INSTRUCTION FOR STUDENTS IN GAS MANUFACTURE. $1.25.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfeld. $1.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5.

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

FINANCES OF GAS AND ELECTRICITY MANUFACTURING ENTERPRISES. By Wm. D. Marks. $1.

PRACTICAL PLUMBING. By P. J. Davies. Vol. I. $3, Vol. II. $4.50.

AMERICAN PLUMBING. By Alfred Revill. $2.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKET-BOOK. By Monroe and Jamieson. $2.50.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK.

THE HUMPHREY LIGHT is made in its entirety in our own shops.

Our lamp business is not a side issue jobbed out among various brass workers. We are the designers and makers of the original gas arc light.

GENERAL GAS LIGHT CO.,
KALAMAZOO, MICH.

54 Warren Street, New York.
530 Market Street, San Francisco.

FRANK D. MOSES,

Long Distance Telephone, 1922, Trenton, N. J.
TRENTON, N. J.,
Long Distance Telephone, 1922 Trenton, N. J.

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE

CORRESPONDENCE SOLICITED.

ARTHUR R. CRUSE, President. FRANK FLAVELL, Secretary. AARON E. KEMPER, Treasurer.

Cruse-Kemper Company,

PHILADELPHIA OFFICES: Stephen Girard Building. - - WORKS: Ambler, Pa.

Manufacturers of

Triple, Double and Single-Lift Gasholders,

With or Without Metal Tanks,

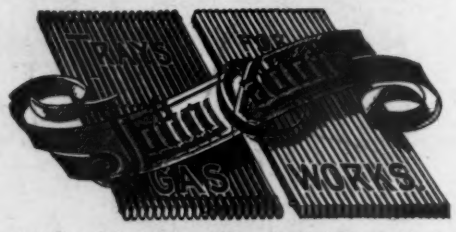
Oil and Water Tanks, Purifier Covers, General Plate Metal Work, and Steel Water Towers.

Plans, Specifications and Estimates Promptly Furnished on Request.

P. PLANTINGA PRES. W.E. STEINWEDELL SEC.
THE
GAS MACHINERY
— CO., —
MAIN OFFICE AND SHOPS
CLEVELAND, O.
N.Y. OFFICE 44 BROAD ST
J.A MAYERS
REPRESENTATIVE
COAL & WATER GAS
APPARATUS,
PURIFIERS, VALVES,
CONNECTIONS,
ROTARY SCRUBBERS,
WASHERS,
BY PRODUCT MACHINERY.
COMPLETE GAS PLANTS

PATENTS, TRADE-MARKS, COPYRIGHTS.
ROYAL E. BURNHAM,
Solicitor of Patents and Counsellor in Patent Causes.
833 Bond Building, Washington, D. C.
Send for Pamphlet on Patents.
1418-tf

Church's Patent Trays.
Reversible; Strongest; Most Easily Repaired.
Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.
We also Supply the Chapest and Strongest
•Reversible Bolted Trays•
IN THE MARKET.
SEND FOR BOOKLET AND CIRCULARS.

FIELD'S ANALYSIS FOR THE YEAR 1902.
An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 34th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by
A. M. CALLENDER & CO., 42 Pine St., New York City.

WHY ARE SO MANY GAS COMPANIES USING THE REEVES' ATTACHMENT?
INQUIRE OF THE
REEVES MFG. CO., - New Haven, Conn.

FRED. BREDEL, President. WM. O. VILTER, Vice-President. O. W. GREENSLADE, Secretary and Treasurer.
FRED. BREDEL COMPANY,
ENGINEERS AND BUILDERS OF GAS PLANTS.
Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.
Special High Grade Material for Recuperative Furnaces.
Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. OFFICE, 405 KEENE ST., MILWAUKEE, WIS.

MAIN AND SERVICE LAYING.
Gas and water companies about to lay new mains or services will find it useful to communicate with us. Our gangs are experienced and our plant is completely equipped for street main and service laying in all branches. These are our specialties. We are in a position to quote prices which will attract the attention of the economical manager.
Gas Company References. Correspondence Solicited.
Telephone, 302 Flushing. SULLIVAN BROS., Flushing, N. Y.

Practical Photometry,
By William Joseph Dibdin.
Price, - - - - $3.00.
FOR SALE BY
A. M. CALLENDER & CO.,
No. 42 Pine Street, New York City.

BRAY BURNERS

Are Used Everywhere,

Because they are the best.
Reliable absolutely.
Accurately marked.
You can't find a city in the world, with gas, not using them.

All Bray Burners are stamped with Name and Trade Mark. Refuse Imitations. Send for Blue Book.

WILLIAM M. CRANE COMPANY,

1131 & 1133 Broadway, New York City.

"THE MINER"

Globe
Street and Boulevard
Lamps.

Cheapest and Best
THOUSANDS IN USE WITH INCANDESCENT BURNERS.
Send for Catalogues.

THOMAS T. W. MINER,
821-823 Eagle Av., N.Y.

Hunt Coal Coke Handling Machinery.

Write for Catalogue.
C. W. HUNT COMPANY,
West New Brighton, N. Y.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

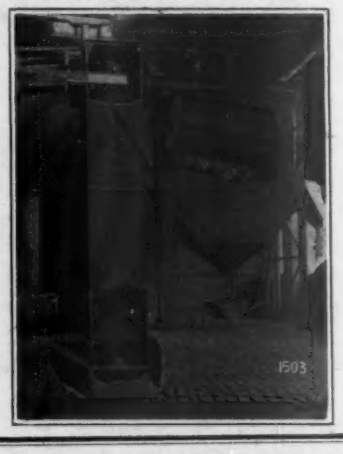
Double and Single Gate Valves, ¼" to 72".

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.



Elevating and Conveying Outfit installed for Mutual Gas Light Co., New York City, for

Reclaiming Coke From Ashes.

Our experience includes designing and installation of all kinds of conveying machinery which make for economy in the manufacture of gas.

LINK-BELT ENGINEERING COMPANY, Philadelphia.

NEW YORK: 49 Dey St.
PITTSBURG: Park Bldg.
CHICAGO: Link-Belt Machinery Co.

J. F. W. JOST,

CHEMICAL ENGINEER
—IN—
GAS MANUFACTURE,

P. O. BOX 2043, PHILADELPHIA, PA.

FINANCES OF

Gas and Electricity Manufacturing Enterprises,

By WM. D. MARKS. Price, $1. For Sale by
A. M. Callender & Co.,
42 Pine Street, New York City.

Practical Handbook on

GAS ENGINES,

With Instructions for Care and Working of the Same,

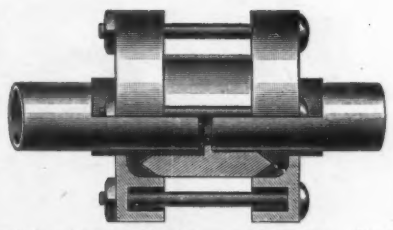
By G. LIECKFELD, C.E.
Translated with Permission of the Author,
By GEO. M. RICHMOND, M.E.

Price, $1. For Sale by
A. M. CALLENDER & CO.,
No. 42 Pine Street, New York City.

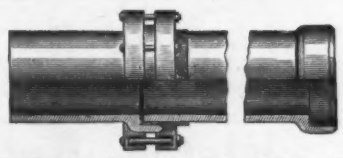
S. R. DRESSER,

BRADFORD, PENNSYLVANIA, U. S. A.,

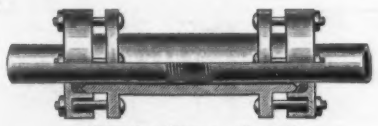
Patentee and Manufacturer of Specialties for Oil and Gas Lines.



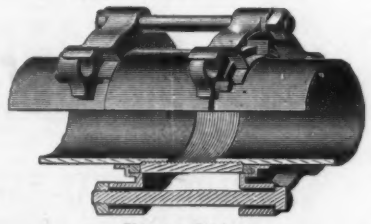
Insulating Coupling for Wrought Iron Pipe. Style 5.



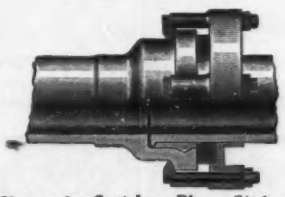
Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.



Regular Sleeve. Style 2.



Clamp. Style 4.



Clamps for Cast Iron Pipe. Style 4¼.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

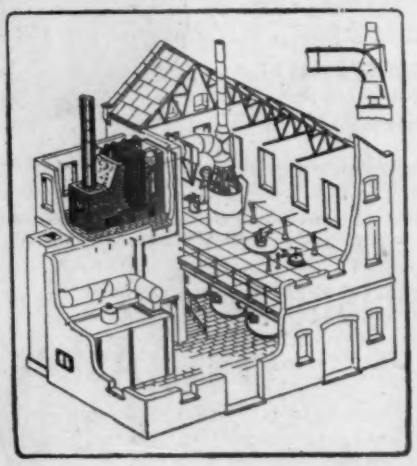
LLOYD CONSTRUCTION COMPANY,
DETROIT, MICH.

GAS WORKS BUILDERS.

Economize Heat in Water Gas Plants,

BY UTILIZING A

Green's Economizer,



To absorb the heat now going to waste when you blow through your superheater to heat the feed water for your boilers to the temperature of the steam. This is now being done at the Poughkeepsie Gas Works, Poughkeepsie, N. Y. : : : : :

Write for full particulars how this is accomplished, the saving effected, and the advantages gained, to the

GREEN FUEL ECONOMIZER CO.,
MATTEAWAN, N. Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

Plans prepared and Estimates furnished at short notice

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

Bristol's Recording
PRESSURE GAUGE.

For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,
Waterbury, Conn.

Silver Medal, Paris Exposition.

Gas Analyses of All Sorts and Conditions,
—OR—
Analyses of Solid and Liquid Materials as Well,

That are needed by Gas Companies at any time in the conduct of their business, may be obtained from

DR. W. H. BIRCHMORE,
1421-tf 341 ADELPHI ST., BROOKLYN, N. Y.

Gas Engineer's Pocket-book, —BY— HENRY O'CONNOR.
Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works. PRICE, $3.50. For Sale by
A. M. CALLENDER & CO., 42 Pine St., N.Y. City

ROOTS' GAS EXHAUSTERS.

Installation showing our latest improved machines, with flexible rope coupling, for large units.

SEND FOR CATALOGUE.

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty St.

CHICAGO OFFICE:
1547 Marquette Building.

COX'S HIGH-PRESSURE FLUID DISCHARGE COMPUTER.

This Computer solves the following formula, which is applicable to Gas, Air and other elastic fluids, flowing through long pipes with high initial pressures:

$$\text{Discharge in cubic feet per hour at atmospheric pressure} = 33.3\sqrt{\frac{d^5 \times (p_1^2 - p_2^2)}{L \times w}}$$

Where d = diameter of pipe in inches,
p_1 = absolute initial pressure in pounds per square inch,
p_2 = absolute terminal pressure in pounds per square inch,
L = length of pipe in miles,
w = specific gravity of the fluid when air = 1.

To Find the Discharge from a Pipe and the Required Size of Pipe.

(1.) Set the specific gravity of the fluid opposite the length of pipe;
(2.) Bring the DIFFERENCE of the initial and terminal gauge pressures opposite the SUM of the initial and terminal gauge pressures;
(3.) Opposite any diameter of pipe will now be found the discharge in cubic feet per hour at atmospheric pressure; and
(4.) Opposite any desired discharge will also be found the required diameter of pipe.

Price of the Computers, in Cloth Case, 6½ x 8 inches, $5 Each, Net.

A. M. CALLENDER & CO., 42 PINE ST., N. Y.

PRACTICAL PHOTOMETRY,

A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.

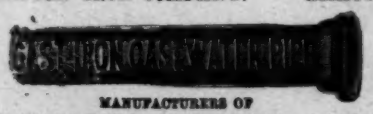
By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations. Price, $3.00.

A. M. CALLENDER & CO., 42 Pine Street, New York City.

M. J. DRUMMOND & CO.
MANUFACTURERS OF
CAST IRON
FLANGE
GAS and WATER PIPE
GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.
EMAUS PIPE FOUNDRY.
DONALDSON IRON COMPANY. EMAUS, PA.



MANUFACTURERS OF
CAST IRON PIPE AND SPECIAL CASTINGS
FOR WATER AND GAS.
Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES
—FOR—
Drilling and Tapping Pipe under Pressure
WITHOUT ANY ESCAPE OF GAS.
They are Strong and Compact.
Size of Combination Drills and Taps ¾ to 4-inch.
Machines Sent to any Gas Company for Thirty Days' Trial.
Send for Circulars.

Geo. Light,
DAYTON, O.

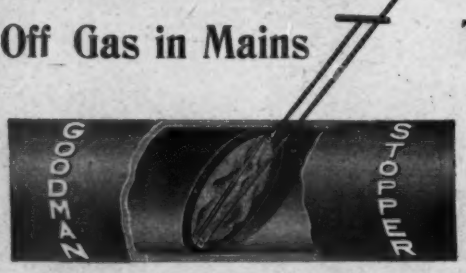
THE ECONOMICAL
GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,
Consulting Engineers.
Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::
PLANS,
SPECIFICATIONS
AND ESTIMATES
PREPARED.
AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

THE
Valuation of Gas, Electricity and Water Works
FOR ASSESSMENT PURPOSES.
THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.
With an Appendix of Decided Cases.
Second Edition. Price $2. For Sale by
A. M. CALLENDER & CO.,
42 Pine Street, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,
Established 1856. Works at Phillipsburgh, N. J.
New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF
Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

SAFETY GAS MAIN STOPPER COMPANY,
For Shutting Off Gas in Mains
Temporarily during alterations and repairs. : : : :
Any size gas main can be shut off in 30 seconds. : : :



STOPPERS SENT ON TRIAL.
Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

FOX HILL FOUNDRY,
F. FERGUSON & SON,
HOBOKEN, N. J.
FINE OPENING
GRATE BARS
FOR GAS WORKS.
STATIONARY, SHAKING, DUMPING.
BARS FOR HAZELTON BOILERS.

LINK-BELT
OPEN TOP CARRIER.
ESPECIALLY ADAPTED FOR HANDLING
Coal, Coke, Ashes, Stone, Ores,
Or any heavy or gritty materials, where strength and durability are essential. Constructed in any length or capacity, and to suit local conditions.
WRITE FOR CATALOG
The Link-Belt Machinery Co.
Link-Belt Engineering Co. Philadelphia
Chicago, U.S.A.

GAS ANALYST'S MANUAL,
By JAQUES ABADY, M. Inst. Mech. E.
(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")
Ninety-three Illustrations and Nine Folding Plates. Bound in Handsome Half Leather. Price, $6.50.
For Sale by A. M. CALLENDER & Co., 42 Pine St., New York City.

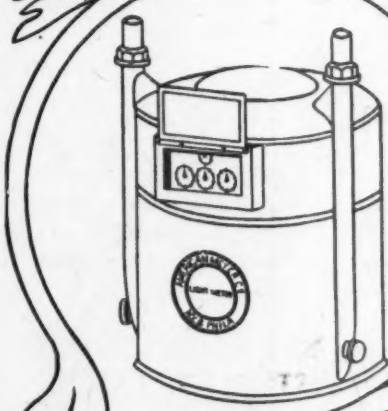
ELECTRIC GAS LIGHTING.
How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.
By H. S. NORRIE.
Price, 50 Cents. Orders may be sent to
A. M. CALLENDER & CO., - - - 42 PINE STREET, NEW YORK CITY.

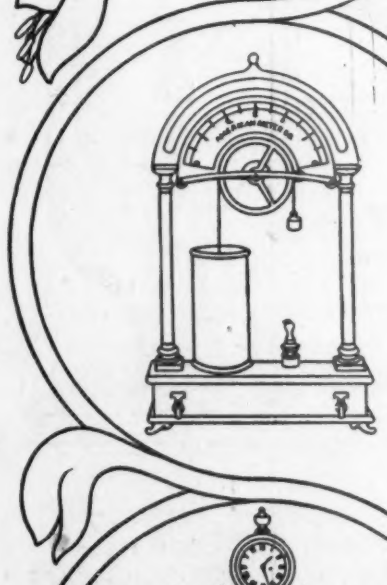
(Copyrighted, 1894, by the AMERICAN METER CO.)

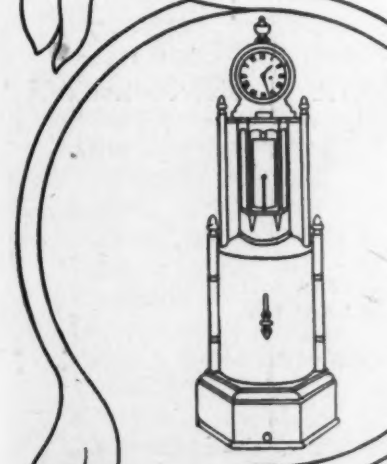
AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK,
PHILADELPHIA,
CHICAGO,
ST. LOUIS,
SAN FRANCISCO.



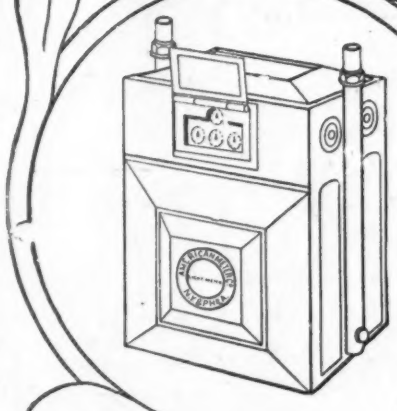


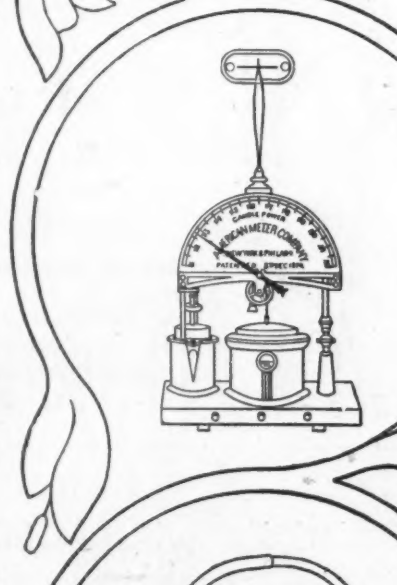


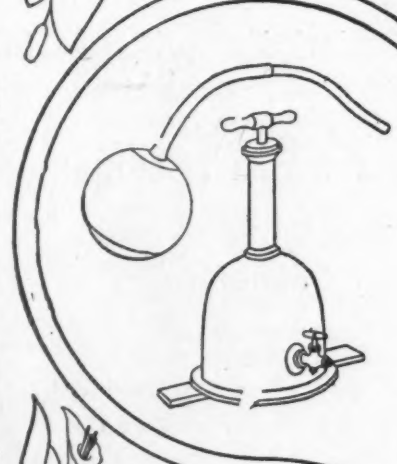
PUBLIC LIGHTING TABLE.

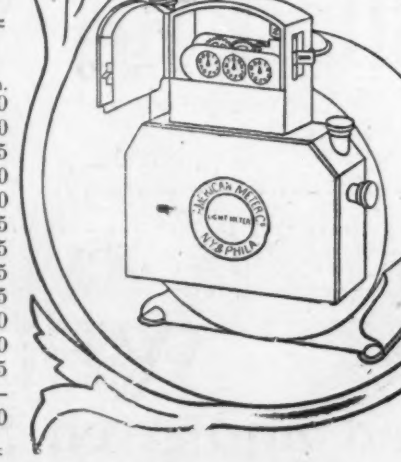
JULY, 1904.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Fri.	1	8.00 PM	10.50 PM	7.30	3.15
Sat.	2	8.00	11.20	7.30	3.15
Sun.	3	8.00	11.50	7.30	3.15
Mon.	4	8.00	12.20 AM	7.30	3.15
Tue.	5	8.00 LQ	12.50	7.30	3.15
Wed.	6	8.00	1.20	7.30	3.15
Thu.	7	8.00	2.00	7.30	3.15
Fri.	8	8.00	2.40	7.30	3.15
Sat.	9	8.00	3.40	7.30	3.15
Sun.	10	8.00	3.40	7.30	3.15
Mon.	11	8.00	3.40	7.30	3.15
Tue.	12	8.00 NM	3.40	7.30	3.15
Wed.	13	8.00	3.40	7.30	3.15
Thu.	14	8.00	3.40	7.30	3.15
Fri.	15	8.00	3.40	7.30	3.15
Sat.	16	8.00	3.40	7.20	3.15
Sun	17	9.30	3.50	7.20	3.15
Mon.	18	10.00	3.50	7.20	3.15
Tue.	19	10.40 FQ	3.50	7.20	3.15
Wed.	20	11.20	3.50	7.20	3.15
Thu.	21	12.00	3.50	7.20	3.15
Fri.	22	12.40 AM	3.50	7.20	3.15
Sat.	23	1.30	3.50	7.20	3.15
Sun.	24	2.20	3.50	7.20	3.15
Mon.	25	No L.	No L.	7.20	3.15
Tue.	26	No L. FM	No L.	7.20	3.15
Wed.	27	No L.	No L.	7.20	3.15
Thu.	28	7.50 PM	8.50 PM	7.20	3.15
Fri.	29	7.50	9.30	7.20	3.15
Sat.	30	7.50	10.00	7.10	3.30
Sun.	31	7.40	10.30	7.10	3.30









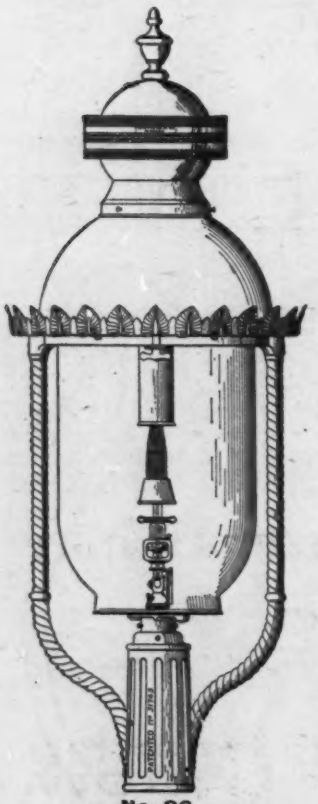
TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00

NEW YORK, 97 Liberty Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Year Ending December 31, 1903. has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Rochester, N. Y.	Chester, Pa.	Savannah, Ga.
Baltimore, Md.	Lynn, Mass.	New York (Central Union Co.)
Chicago, Ills.	Newark, N. J.	Cicero, Ills.
Amesbury, Mass.	Washington, D. C.	Chicago (Ogden Co.)
Aberdeen, S. D.	Boone, Ia.	Easton, Pa.
Winsted, Conn.	Pueblo, Col.	Lawrence, Mass.
Canon City, Col.	Charlotte, N. C.	Council Bluffs, Ia.
Schenectady, N. Y.	Fall River, Mass.	Chattanooga, Tenn.
Hagerstown, Md.	Duluth, Minn.	Tuckerton, N. J.
Malden, Mass.	New York (Mutual Co.)	Springfield, O.
Bridgeport, Conn.	Waltham, Mass.	Easton, Pa. (2d contract).
Albert Lea, Minn.	Dover, Del.	Mobile, Ala.
Brooklyn, N. Y.	York, Pa.	Conshohocken, Pa.
Kansas City, Kas.	Minneapolis, Minn.	Mason City, Ia.
Hempstead, N. Y.	Allentown, Pa.	

TOTAL SETS FOR 1903, ... 62
TOTAL DAILY CAPACITY, ... 62,950,000 cubic feet.
TOTAL SETS TO DATE, ... 508
TOTAL DAILY CAPACITY, ... 362,780,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

LACLEDE

Fire Brick Manufg. Co.,

Manufacturers of { CAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
Cor. Manchester and Sulphur Avenues, St. Louis, Mo.

Established 1845. Reorganized 1902.

The Kreischer Brick Mfg. Co.,

Manufacturers of the very best quality of Clay Retorts, Blocks, Tiles, Settings and Firebrick of every description.

Also Miners and Shippers of Fireclay, Fire Sand, Ground Brick in Barrels.

WORKS: KREISCHERVILLE, STATEN ISLAND.
OFFICE: 119 E. 23D STREET, NEW YORK CITY.

Adam Weber Sons.

WORKS: Weber, N. J.
GENERAL OFFICE: Park Row Bldg., N. Y. City.
DEPOT AND YARD: 639 E. 15th St., N. Y. City

FITCHBURG GAS & ELECTRIC LIGHT CO.,
FITCHBURG, MASS., MAY 23D, 1904.

MR. JOHN HARWOOD, President Natick Gas Company, Natick, Mass.:

Dear Sir—I understand you are about putting in some new benches of retorts, and are undecided whether you will put in the Portland or Weber system. After using the Weber system for 6 or 8 years, and having benches run from 24 months to 30 months without resetting, and having used the Portland benches one year and one of them is burned out now and wants resetting, I have ordered a Weber bench for it. Now that is my experience after using the two different settings, and from my own experience I would put in the Weber benches every time. While there is a little more cost in the beginning, it is the cheapest in the long run.

Yours truly,
(Signed)
FITCHBURG GAS & ELECTRIC LIGHT CO.,
H. F. COGGSHALL.

ISAAC C. BAXTER, President. ESTABLISHED 1864. PETER YOUNG, Sec'y and Treas.

Works,
LOCKPORT STATION, PA.

JAMES GARDNER, JR., CO.,

Address all communications to
JAMES GARDNER, JR., CO., Room 202 Lewis B'l'dg.
PITTSBURGH, PA.

Successor to WILLIAM GARDNER & SON.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. BLOOMINGTON, INDIANA.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, BLOOMINGTON, IND.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

The Gas Engineer's Pocket-Book,

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

For Sale by

A. M. CALLENDER & CO., 42 Pine Street, New York City.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the Exclusive Agents *for the* Mitchell Patent Benches, *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* Rear Clinkering. The Mitchell *is the* Original Coal Firing Bench. *We also Erect Plain Benches with* One *to* Six Retorts.

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office:
411 Olive Street,
Continental Bank,
ST. LOUIS, MO.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y. Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are being furnished for Detroit, Mich.

These are the only machines that will draw or charge simultaneously three or four retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

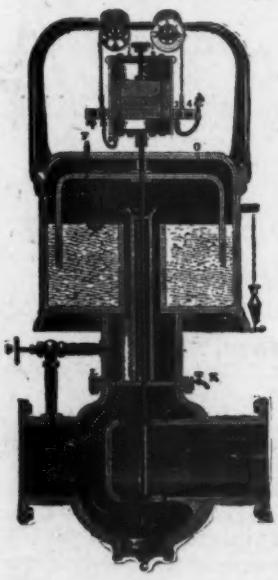
Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Can., working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

G. A. BRONDER,
Contracting Engineer and Builder.
229 BROADWAY. NEW YORK.

CONNELLY IRON SPONGE AND GOVERNOR CO.,



CONSTRUCTORS OF

Coal Gas Apparatus.

Automatic, Balance and Service Gas Governors.
Roots Improved Gas Exhausters.
Iron Sponge for Gas Purification.
Jones Jet Photometers, Pressure Registers, etc.

GAS SPECIALTIES.

395 Broadway, New York. 788 South Canal St., Chicago, Ills.

PRACTICAL PHOTOMETRY,

By WILLIAM JOSEPH DIBDIN,

PRICE, $3. FOR SALE BY

A. M. CALLENDER & CO., 42 Pine Street, New York City.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 42 Pine St., N. Y. City

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming.

A. C. M. AZOY, General Agent, 1 Broadway, New York.

JEFFREY ELEVATORS FOR ALL KINDS OF WORK.

COAL HANDLING MACHINERY.

COKE CRUSHERS.

SHAKING SCREENS.

POWER TRANSMISSION MACHINERY.

ASHES HANDLING MACHINERY.

SEND FOR CATALOGUE.

THE JEFFREY MFG. CO.,

COLUMBUS, O., U. S. A.

NEW YORK, CHICAGO, DENVER, BUFFALO, PHILADELPHIA.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C. Price, $3.50.

Orders may be sent to

A. M. CALLENDER & CO., 42 Pine St., N. Y.

COAL TAR
— AND —
AMMONIA.

Third and Enlarged Edition.

BY

GEORGE LUNGE, Ph.D.

Price, $15. For Sale by

A. M. CALLENDER & CO.,

42 Pine Street, New York City.

SELF-INSTRUCTION

For Students in Gas Manufacture.

Price, $1.25. For Sale by

A. M. Callender & Co.,

42 Pine Street, New York City.

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 cents. Orders may be sent to

A. M. CALLENDER & CO., 42 PINE ST., N. Y. CITY.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.
For sale by
A. M. Callender & Co., 42 Pine St., N. Y.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by
A. M. CALLENDER & CO., 42 Pine St., N.Y. City.

BINDER for the JOURNAL.

Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N.Y.

Edmund H. McCullough, President. Chas. F. Godshall, Treasurer. H. C. Adams, Secretary. Henry Wharton, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

SUN COMPANY,

PRODUCER, REFINER, SHIPPER AND EXPORTER OF
Petroleum and All Its Products.
Pittsburg, Pa., and Philadelphia, Pa.

THE SUN OIL CO.

Gas Oil, Gas Naphtha,
Refined Oil, Lubricating Oils.
Toledo, O., and Pittsburg, Pa.

FERROINCLAVE FIREPROOF ROOFING.

Light, Cheap, Not Injured by Steam or Sulphurous Gases.
DESCRIBED IN OUR FERROINCLAVE PAMPHLET.

The Brown Hoisting Machinery Co.,
New York. Cleveland. Pittsburg.

Standard Oil Company,

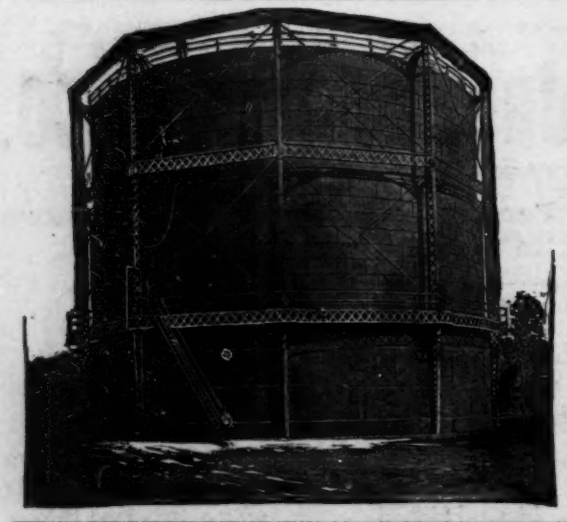
GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe. Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING,

Rooms 201 & 202. DETROIT, MICH.

A. E. BOARDMAN, C. E.,

Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

Edison Building, 42 and 44 Broad St.,

NEW YORK CITY.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

Established 1876.

National Paint Works.

PAINTS FOR METAL SURFACES.

We Sell 65 Per Cent. of the Gasholder Paint in the United States.

SALES OFFICE:	FACTORY:	SALES OFFICE:
Great Northern Bldg., Chicago.	Williamsport, Pa.	92 William Street, New York City.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

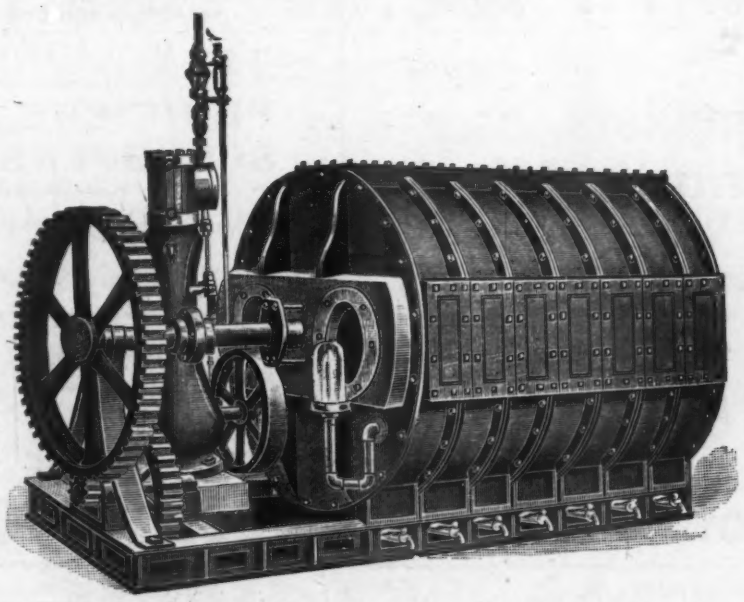
ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, {FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Designers and Builders of Gas Works.



Sole Lessees the Wilkinson Water Gas Process.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

Coal and Water Gas Installations of the Most Modern and Complete Types.

BENCHES WITH INCLINED RETORTS.

System Stettiner Chamotte Fabrik, Actien Gesellschaft, of Stettin, Germany.

GASHOLDERS OF ALL SIZES.

General Western Agents, THE LLOYD CONSTRUCTION CO., of Detroit, Mich.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

ALEX. C. HUMPHREYS, M.E., M. Inst. C.E. ARTHUR G. GLASGOW, M.E., M. Inst. C.E.

HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

38 VICTORIA STREET, London S.W., England.

CONSULTING GAS AND ELECTRIC LIGHT ENGINEERS.

PROPERTIES PURCHASED.

COMPLETE EXAMINATIONS MADE.

R. D. WOOD & CO.,

400 CHESTNUT ST., PHILADELPHIA,

MANUFACTURERS OF

Cast Iron Pipe.

HEAVY LOAM CASTINGS,

Dunham Specials,

Hydraulic Work,

LAMP POSTS, VALVES, ETC.,

Gas Power Plants with Producers.

BUILDERS OF

Gasholders.

Single or Multiple Lifts, with or without Metal Tanks.

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

Cutler's Patent Freezing Preventer for Holder Cups.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

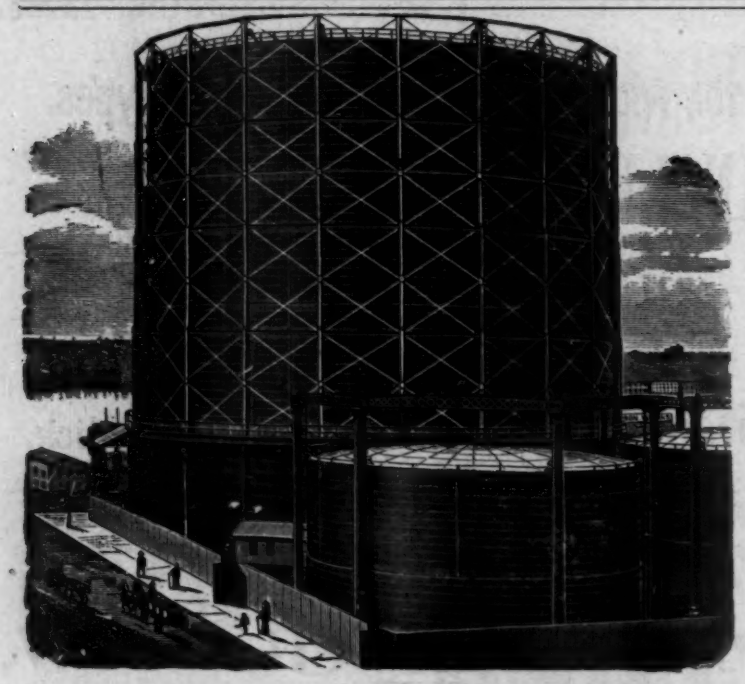
TOTAL ROTARY AMMONIA SCRUBBERS SOLD,

98,806,000 Cu. Feet Daily Capacity.

TOTAL WALKER TYPE TAR EXTRACTORS SOLD,

84,900,000 Cu. Feet Daily Capacity.

OFFICE AND WORKS: Bridge and Ogden Streets, Newark, N. J.



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN R. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries),
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

THE GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.

PRICE, - - - - - - - $2.50.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City

THE STACEY MANUFACTURING COMPANY,

MANUFACTURERS AND BUILDERS OF

GASHOLDERS AND STEEL TANKS

AND ALL IRONWORK AND MACHINERY REQUIRED IN A GAS PLANT.

Also Oil Storage Tanks, Steel Roofs, Stand Pipes, Etc.

We also manufacture Lamp Posts, Gas Valves, all size and shape Castings, Etc.

The only authorized manufacturers of "THE CHOLLAR SYSTEM OF GAS PURIFICATION."

Plans, Specifications and Estimates Cheerfully Furnished on Request.

GENERAL OFFICES:

No. 239 Mill Street, CINCINNATI, OHIO. 'Phone, West 690.

EASTERN SALES AGENT:

FRANK D. MOSES, 7 North Stockton Street, TRENTON, N. J.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WM. HENRY WHITE,

EDISON BUILDING, No. 44 BROAD STREET, = = = NEW YORK CITY,

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.

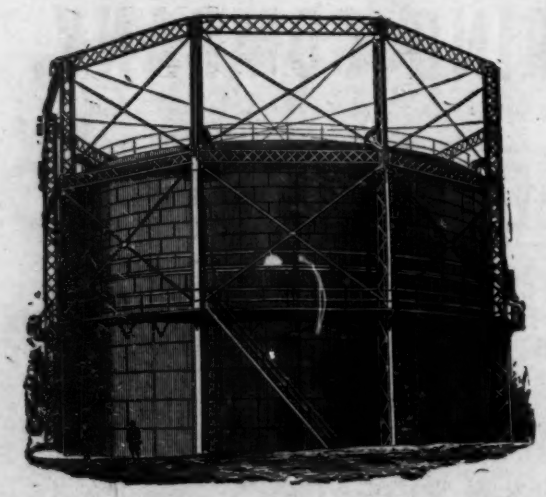
Plans and Estimates Furnished.

1903 DIRECTORY 1903

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 42 Pine Street, New York.



1842 ❊ Deily & Fowler, ❊ 1904

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu. Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.,

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete, with Steel Tanks.

BENCHES, SCRUBBERS,

CONDENSERS,

PURIFIERS, IRON ROOFS,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for Complete Works.

Gas Analyst's Manual,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates.

Bound in Handsome Half Leather. Price, - $6.50.

FOR SALE BY

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

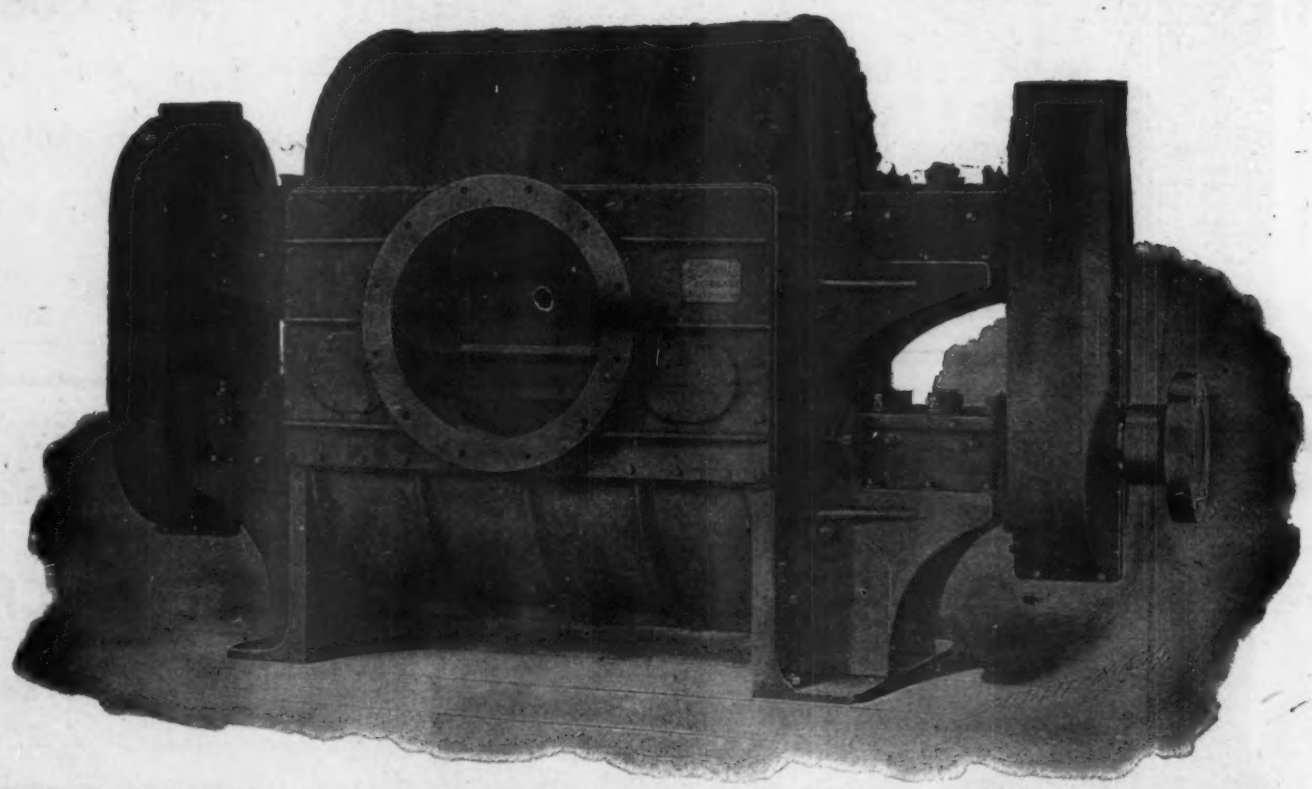
Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.



HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR.

CONNERSVILLE BLOWER CO., Connersville, Ind. EASTERN SALES OFFICE: 95-97 Liberty St., New York City.

We Have Sold Over 50,000 of Our

PREPAYMENT GAS METERS

IN NEW ENGLAND.

We Have Fitted Up Over 10,000 Idle Regular Meters with Our

PREPAYMENT ATTACHMENT.

Can be Attached to Any Make of Meter.

NATHANIEL TUFTS METER COMPANY, 8 MEDFORD STREET, BOSTON, MASS.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. **CHICAGO, 88 to 92 Jackson Boulevard.**

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

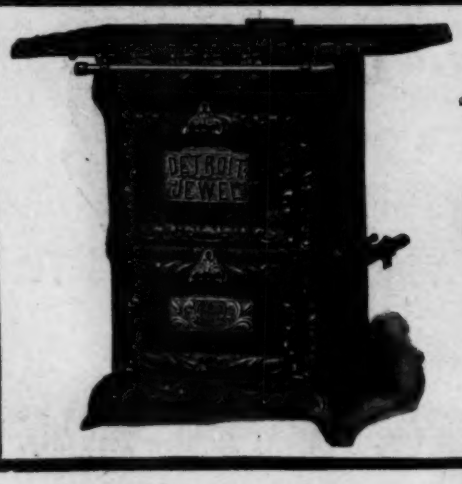
SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

THE PREPAYMENT.

We offer a thoroughly first-class prepayment meter.
We will fit our Reeves Attachments to your regular meters, repairing them at the same time if necessary.
We will sell you the Attachments, and you can put them on.
Which will you have?

KEYSTONE METER CO., Royersford, Pa.



DETROIT STOVE WORKS

"Largest Stove Plant in the World"

MANUFACTURES AND SELLS

DETROIT JEWEL GAS APPLIANCES

FOR COOKING and HEATING,

All about which is told in a fine and strictly "to-the-point" catalog, sent upon request to Gas Companies.

DETROIT, MICH. CHICAGO, ILLS.

AMERICAN METER COMPANY,

NEW YORK, PHILADELPHIA, CHICAGO.
SAN FRANCISCO, ST. LOUIS.

PREPAYMENT METERS.

THEIR CONSTRUCTION IS SUCH THAT THEY MAY BE READILY READJUSTED WHEN THE SCALE OF GAS RATES IS CHANGED.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes

FACTORY AT ERIE, PA.

FOR SALE, NASH GAS ENGINE.

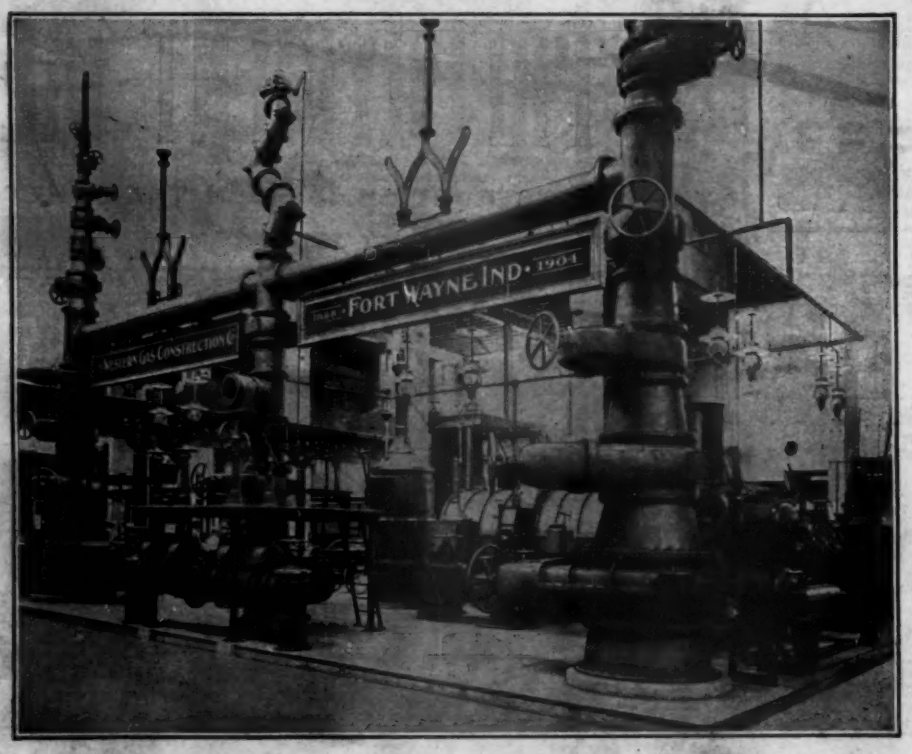
Fifty-horse power, 3-cylinder, latest type. Made by the National Meter Company. Engine can be run either on gas or gasoline. In use less than a year and as good as new. A desirable engine where natural gas is abundant and close regulation is not expected. For further particulars address

BUHL STAMPING CO., Detroit, Mich.

COUNTED PE

THE WESTERN GAS CONSTRUCTION CO.'S

Palace of Manufactures.



Section 15A.

WORLD'S FAIR EXHIBIT

OF

GAS WORKS APPARATUS.

Gas men and all others interested in Gas Works and Apparatus who will attend the Louisiana Purchase Exposition at St. Louis from now until December 1st will surely want to see one of the most complete exhibits of Gas Apparatus that has ever been made at any International Exposition.

GAS FRATERNITY ALWAYS WELCOME

AT

SECTION 15A, PALACE OF MANUFACTURES.

Main Office and Works, - - Fort Wayne, Ind.

LB 0 '04